SOLVAY
SODA ASH JOINT VENTURE

June 4, 1997

Bernie Dailey
WDEQ/AQD
122 West 25th Street
Cheyenne, WY 82002

Dear Mr. Dailey:

Enclosed you will find four copies of an air quality application and support documentation for a permit to construct an expansion of Solvay Soda Ash Joint Venture's soda ash facility. I understand that you will forward one copy to the USEPA Region VIII and one to the U.S. Forest Service. This permit has been prepared in accordance with Wyoming Air Quality Standards and Regulations.

The location of the facility is in the NE 1/4 of Section 31, T18N, R109W, approximately twenty miles west of Green River, Wyoming. The proposed expansion to the existing facility will enable the production of an additional 1.2 million tons per year (MMTPY) of soda ash (anhydrous sodium carbonate), bringing the total permitted capacity to 3.6 MMTPY. The modifications and new facilities required for this expansion will result in pollutant emission increases that are in exceedance of PSD de mimimis levels for PM_{10}, CO, and VOC. The NO_X emission increase is offset by an NO_X reduction realized from a previous permit.

We would appreciate an expeditious review of this permit application as Solvay Soda Ash Joint Venture anticipates the commencement of construction in October, 1997. We look forward to your reply and will promptly respond to any questions or comments that you may have concerning the application. I can be contacted at (307) 872-6571.

Sincerely,

Dolly A. Potter
Environmental Engineer

Enclosures

cc: Lee Gribovicz - WDEQ/AQD Lander, WY

Department of Environmental Quality

Division of Air Quality

Permit Application

1.   Company Name: Solvay Soda Ash Joint Venture

2.   Mailing address: P.O. Box 1167 (20 miles west of Green River) Green River, Wyoming 82935

3.   Plant name (if different from #1):   (same)

4.   Plant Location (if different from #2):   NE ¼ of Section 31, Township 18 North, Range 109 West

Sweetwater County, Wyoming

Plant Mailing Address: (same as above)

5.   Name of Owner: Solvay Soda Ash Joint Venture   Phone (307) 875-6500

6.   Responsible Official: Richard L. Casey   Phone (307) 875-6500

7.   Permit application is made for:

   X   New construction   X   Modification

_____ Relocation   _____ Operation

8.   Type of equipment to be constructed, modified, or relocated. (Please list each major piece of equipment separately.)

Covered Ore Storage	Crusher	Screens	Calciner	Rake Classifiers
Tanks	Filters	Crystallizers	Centrifuges	Product Dryer
Silos	Industrial Boiler			

9.   If application is being made for operation of an existing source in a new location, list previous location and new location: N/A

Previous location: _____

New location: _____

10.   Crushing Activities: No open crushing

   a. Primary crushing   Type control equipment Baghouse_____

   b. Secondary crushing   Type control equipment _____

   c. Tertiary crushing   Type control equipment _____

   d. Recrushing & screening   Type control equipment Baghouse_____

   e. Conveying   Type control equipment Baghouse_____

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f. Drying   Type control equipment __N/A_____

g. Other   Type control equipment _____

Proposed dates of operation (month/year)   **Phase 1 - June, 1999**
                                            Phase 2 - January, 2001
                                            Phase 3 - January, 2003

11.   Materials used in unit or process (include solid fuels):

Material	Process Weight Average (lb/hr)	Process Weight Maximum (lb/hr)	Quantity/Year
Trona Ore	468,000	550,000	2.05 MM TPY

12. Air contaminants emitted:

Emission Point	Pollutant	lb/hr	ton/yr	Basis of Data
AQD #74 (North Headframe)	PM_{10}	0.34	1.79	Vendor Guarantee @ 0.01 gr/dscf
AQD #75 (Primary Crushing)	PM_{10}	0.34	1.49	Vendor Guarantee @ 0.01 gr/dscf
AQD #76 (Primary Screening)	PM_{10}	3.70	16.21	Vendor Guarantee @ 0.01 gr/dscf
AQD #77 (Transfer 101)	PM_{10}	0.22	0.96	Vendor Guarantee @ 0.01 gr/dscf
AQD #78 (Transfer 102)	PM_{10}	0.27	1.18	Vendor Guarantee @ 0.01 gr/dscf
AQD #79 (Transfer Point)	PM_{10}	0.21	0.92	Vendor Guarantee @ 0.01 gr/dscf
AQD #80 (Calciner #4 ESP)	PM_{10}	11.93	52.25	Vendor G @ 0.015 gr/dscf
	NO_x	20.00	87.60	Vendor G @ 0.05 lb/MM Btu
	CO	1048	4,590	Test estimate @ 3.81 lb/ton ore
	VOC	533.5	2,337	Test estimate @ 1.94 lb/ ton ore
	SO_2	0.0	0.0	Test estimate
AQD #81 (Dryer Area)	PM_{10}	1.74	7.62	Vendor Guarantee @ 0.01 gr/dscf
AQD #82 (Dryer ESP)	PM_{10}	4.08	17.87	Vendor G @ 0.01 gr/dscf
	NO_x	30	131.4	Vendor G @ 0.15 lb/MM Btu
	CO	14	61.32	Vendor G @ 0.07 lb/MM Btu
	VOC	0.27	1.18	AP-42 Table 1.4-1
	SO_2	0.0	0.0	Test Estimate
AQD #83 (Silo Top)	PM_{10}	0.29	1.27	Vendor Guarantee @ 0.01 gr/dscf
AQD #84 (Silo Bottom)	PM_{10}	0.59	2.58	Vendor Guarantee @ 0.01 gr/dscf
AQD #85 (Industrial Boiler)	PM_{10}	0.48	2.10	AP-42 Table 1.4-1
	NO_x	3.80	16.64	Vendor G @ 0.038 lb/MM Btu
	CO	9.00	39.42	Vendor G @ 0.09 lb/MM Btu
	VOC	0.28	1.23	AP-42 Table 1.4-1
	SO_2	0.06	0.26	AP-42 Table 1.4-1

Emission Point	Pollutant	lb/hr	ton/yr	Basis of Data
AQD #17 (Calciners #1 & #2) (Increases due to modification)	PM_{10}	N/C	N/C	Estimate @ 0.022 gr/dscf
	NO_x	5.0	21.9	Estimate @ 0.05 lb/MM Btu
	CO	285.75	1251.6	Test estimate @ 3.81 PPT
	VOC	145.5	635.1	Test estimate @ 1.94 PPT
	SO_2	0	0	Test estimate
AQD #48 (Calciner #3) (Increases due to modification)	PM_{10}	N/C	N/C	Estimate @ 0.018 gr/dscf
	NO_x	2.5	10.95	Estimate @ 0.05 lb/MM Btu
	CO	142.88	625.79	Test estimate @ 3.81 PPT
	VOC	72.75	318.65	Test estimate @ 1.94 PPT
	SO_2	0	0	Test estimate

Note: CO emissions of 0.074 lb/MM Btu due to combustion of natural gas, the 3.81 PPT test estimate is due primarily from the incomplete combustion of ore

Maximum VOC emissions of 1.94 PPT, average of 0.766 PPT.

13.   Air contaminant control equipment:

Emission Point	Type	Pollutant Removed	Efficiency
AQD #74	Baghouse	PM_{10}	99.99 %
AQD #75	Baghouse	PM_{10}	99.99 %
AQD #76	Baghouse	PM_{10}	99.99 %
AQD #77	Baghouse	PM_{10}	99.99 %
AQD #78	Baghouse	PM_{10}	99.99 %
AQD #79	Dust Collector	PM_{10}	99.99 %
AQD #80	ESP	PM_{10}	99.99 %
	Low NO_X Burner	NO_X	90.6 %
AQD #81	Baghouse	PM_{10}	99.99 %
AQD #82	ESP	PM_{10}	99.99 %
	Flame Grid Burner	NO_X	71.8 %
AQD #83	Dust Collector	PM_{10}	99.99 %
AQD #84	Baghouse	PM_{10}	99.99 %
AQD #85	Low NO_X Burner	NO_X	71.9
AQD #17	ESP	PM_{10}	99.9 %
	Low NO_X Burner	NO_X	90.6 %
AQD #48	ESP	PM_{10}	99.9 %
	Low NO_X Burner	NO_X	90.6 %

14.   Type of combustion unit(check if applicable) :

A.   Coal _____

1. Pulverized _____:

General _____; Dry Bottom _____; With Flyash Reinjection _____;

2. Spreader Stoker _____:

With Flyash Reinjection _____; Without Flyash Reinjection _____; Cyclone _____;

Hand-Fired _____;

B. Fuel Oil_____

Horizontally Fired _____; Tangentially Fired _____;

C. Natural Gas ___X___

D. If other, please specify_____

Hourly fuel consumption (estimate for new equipment):
Calciner #4 (AQD #82) 386,473 scf /hr
Dryer #7 (AQD #80) 193,237 scf/hr
Industrial Boiler (AQD #85) 96,618 scf/hr
Calciners # 1 & 2 (AQD #17) additional 96,618 scf/hr (483,092 scf/hr total)
Calciner #3 (AQD #48) additional 48,309 scf/hr (241,546 scf/hr total)

Size of combustion unit:
Calciner #4 (AQD #82) - 400 MM BTU heat input/hour
Dryer #7 (AQD #80) - 200 MM BTU heat input/hour
Industrial Boiler (AQD #85) - 100 MM BTU heat input/hour
Calciners #1&2 (AQD #17) - additional 50 MM Btu heat input/hr each (total of 500 MM Btu/hr)
Calciner #3 (AQD #48) - additional 50 MM Btu hear input/hr (total of 250 MM Btu/hr)

15. Operating Schedule: __24__ hours/day; __7__ days/week; __52__ weeks/year.

Peak production season (if any): _____ **None** _____

16. Fuel analysis:

	A. Coal	B. Fuel Oil	C. Natural Gas
% sulfur			negligible
% ash			negligible
BTU Value			1035 Btu/SCF

17. Products of process or units:

Products	Quantity/Year
Soda Ash (anhydrous sodium carbonate)	1.2 MM Tons/Year

18.   Emissions to the atmosphere (each point of emission should be listed separately and numbered so that it can be located on the flow sheet):

Emission Point	Stack Height (ft)	Stack Diameter (ft)	Gas Discharged SCFM (DSCFM / ACFM)	Exit Temp (°F)	Gas Velocity (ft/s)
AQD #74	105	1.33	3,750 (4,000 / 5,000)	60	60
AQD #75	25	1.33	3,750 (4,000 / 5,000)	60	60
AQD #76	25	4.42	40,500 (43,150 / 54,000)	60	59
AQD #77	40	1.083	2,400 (2,600 / 3,250)	60	59
AQD #78	70	1.25	3,000 (3,200 / 4,000)	60	54
AQD #79	70	1.083	2,250 (2,400 / 3,000)	60	54
AQD #80	180	9.83	129,000 (92,750 / 264,000)	338	58
AQD #81	180	3.58	19,200 (20,250 / 35,000)	250	58
AQD #82	180	7.08	70,300 (47,555 / 138,000)	305	58
AQD #83	130	1.42	3,100 (3,350 / 5,300)	200	56
AQD #84	50	2.00	6,500 (6,900 / 11,000)	200	58
AQD #85	140	4.22	(22,275 / 42,000)	325	50
AQD #17	180	12.0	(120,424 / 312,000)	375	46
AQD #48	180.5	10.5	(60,212 / 156,000)	350	30

19.   Does the input material or product from this process or unit contain finely divided materials which could become airborne?

         __X__ Yes   ____ No

Is this material stored in piles or in some other way as to make possible the creation of dust problems?

___ Yes   __X__ No

List storage piles (if any):

Type of Material	Particle Size (Diameter or Screen Size)	Pile Size (Average Tons on Pile)	Pile Wetted (Yes or No)	Pile Covered (Yes or No)
Trona	8" x 8"	50,000	No	Yes

20. Using a flow diagram:

    (1)   Illustrate input of raw materials.

    (2)   Label production processes, process fuel combustion, process equipment, and air pollution control equipment.

    (3)   Illustrate locations of air contaminant release so that emission points under items 11, 12 and 17 can be identified. For refineries, show normal pressure relief and venting systems. Attach extra pages as needed.

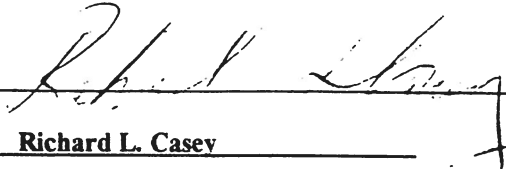   **See Process Flow Diagrams and AQ-300, Soda Ash Expansion II Air Quality Sources Plot Plan and Key**

21. A site map should be included indicating the layout of facility at the site. All buildings, pieces of equipment, roads, pits, rivers and other such items should be shown on the layout.

    See AQ-300, Soda Ash Expansion II Air Quality Sources Plot Plan

22. A location drawing should be included indicating location of the facility with respect to prominent highways, cities, towns, or other facilities (include UTM coordinates).

    See Figure 2-1, Site Location Map

"I certify to the accuracy of the plans, specifications, and supplementary data submitted with this application. It is my opinion that any new equipment installed in accordance with these submitted plans and operated in accordance with the manufacturer's recommendations will meet emission limitations specified in the Wyoming Air Quality Standards and Regulations."

Signature _____

Typed Name __Richard L. Casey_____

Title _____Vice President_____

Company _Solvay Soda Ash Joint Venture_____

Mailing Address _P.O. Box 1167, Green River, Wyoming 82935_ Telephone ____(307) 875-6500_

P.E. Registration (if applicable) __N/A_____

State where registered_____

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SECTION 6

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TABLE OF ACRONYMS

TABLE OF CAS NUMBERS

Compound	CAS #
ACETALDEHYDE	75-07-0
ACETONE	67-64-1
ACETOPHENONE	98-86-2
ACROLEIN	107-02-8
ACRYLONITRILE	107-13-1
BENZENE	71-43-2
BIPHENYL	92-52-4
BIS(2-ETHYLHEXYL)PHTHALATE	117-81-7
1,3 BUTADIENE	106-99-0
2-BUTANONE (METHYL ETHYL KETONE)	78-93-3
2-CHLOROACETOPHENONE	532-27-4
CUMENE	98-82-8
DIBENZOFURAN	132-64-9
DI-N-BUTYL PHTHALATE	84-74-2
ETHYL BENZENE	100-41-4
FORMALDEHYDE	50-00-0
HEXANE	110-54-3
METHYLENE CHLORIDE	75-09-2
3/4-METHYLPHENOL	108-39-4/106-44-5
N,N-DIMETHYLANILINE	121-69-7
NAPHTHALENE	91-20-3
PHENOL	108-95-2
PROPIONALDEHYDE	123-38-6
STYRENE	100-42-5
TOLUENE	108-88-3
1,1,1-TRICHLOROETHANE	71-55-6
TRICHLOROETHENE (TRICHLOROETHYLENE)	79-01-6
XYLENE	1330-20-7

x

1. INTRODUCTION

This air quality permit application is submitted by the Solvay Soda Ash Joint Venture (SSAJV) for a Permit to Construct and a Prevention of Significant Deterioration (PSD) Permit. Construction and modifications to the SSAJV's Green River facility will allow the processing of an additional 1.2 million tons per year (MM TPY) of soda ash. This facility is located near Green River, Wyoming, and has been operating since 1982. This application is being submitted to the Wyoming Department of Environmental Quality, Air Quality Division (WDEQ/AQD), to meet requirements of the Wyoming Air Quality Standards and Regulations (WAQS&R).

The new and modified facilities will be constructed at the existing Green River facility. These modifications are anticipated to result in significant increases in the following criteria pollutants: particulate emissions (assumed to be less than ten microns in diameter, PM_{10}), nitrogen oxides (NO_x), carbon monoxide (CO) and volatile organic compounds (VOCs). The VOC emissions contain some species which are listed under Title III of the Clean Air Act Amendments (CAAA) as Hazardous Air Pollutants (HAPs). PSD permitting requirements and review are triggered for PM_{10}, CO, and VOC emissions. Due to recent projects resulting in a reduction of NO_x emissions, the increase in NO_x emissions resulting from this project will be offset. Emissions of all other criteria pollutants are below the de minimis emission levels and are not subject to PSD review. Top-Down Best Available Control Technology (BACT) has been addressed for all pollutants, as well as ambient impacts due to emissions from the entire facility.

This report and attached cover letter serve as support documentation in the actual permit application to assess the potential air quality impacts of the Solvay Soda Ash Joint Venture facility with the proposed soda ash expansion.

2. PROCESS DESCRIPTION

This section presents descriptions of Solvay Soda Ash Joint Venture's existing soda ash, trona products, caustic/sulfite/metabisulfite, and bagging facilities in relationship to proposed modifications. Details of the existing facility and proposed modifications to increase soda ash production are provided separately after a summary of the permitting history.

2.1 SUMMARY OF PERMITTING HISTORY

The following table summarizes the history of permitted sources at the SSAJV facility. A key for the abbreviations follows the table.

Table 2-1: Summary of Permit History

AQD	Name	Year	1979	1981	1984	1986	1990	1990	1992	1995	1996	
		Permit	234	234A	234A2	643A	117	132	946	229	282	New
1	Head Frame		NS	UC	UC	UC	DL	-----	-----	-----	-----	-----
2	Ore Crushing Bldg.		NS	UC	DL	-----	-----	-----	-----	-----	-----	-----
2a	Ore Crusher		-----	-----	AD	UC	MD*	UC	UC	UC	UC	UC
2b	Ore Reclaim		-----	-----	AD	UC	MD*	MD	UC	UC	UC	DL
3	Ore Storage		NS	UC	DL	-----	-----	-----	-----	-----	-----	-----
3a	ROM Stockpile Center		-----	-----	AD	UC	DL	-----	-----	-----	-----	-----
3b	ROM Stockpile North		-----	-----	AD	UC	DL	-----	-----	-----	-----	-----
3c	ROM Stockpile South		-----	-----	AD	UC	DL	-----	-----	-----	-----	-----
4	Temp. Ore Stockpile		NS	UC	UC	UC	DL	-----	-----	-----	-----	-----
5	Product Transfer		NS	UC	DL	-----	-----	-----	-----	-----	-----	-----
6	Product Storage		NS	UC	DL	-----	-----	-----	-----	-----	-----	-----
6a	Top Silos		-----	-----	AD	UC	MD*	MD	UC	UC	UC	UC
6b	Silo Reclaim		-----	-----	AD	UC	MD*	UC	UC	UC	UC	MD*
7	Product Load Out		NS	UC	UC	UC	MD*	UC	UC	MD	UC	UC
8	Coal Unloading		NS	UC	UC	UC	DL	-----	-----	-----	-----	-----
9	Covered Coal Storage		NS	UC	UC	UC	DL	-----	-----	-----	-----	-----
10	Coal Crushing		NS	UC	UC	UC	MD*	UC	UC	MD	UC	UC
11	Coal Transfer		NS	UC	UC	UC	MD*	UC	UC	MD	UC	MD*
12	Coal Conveyor		NS	UC	UC	UC	MD*	UC	UC	DL	-----	-----
13	Coal Conveyor		NS	UC	DL	-----	-----	-----	-----	-----	-----	-----
14	Boiler Coal Bunker		NS	UC	UC	UC	UC	UC	UC	UC	UC	MD*
15	DR 1&2		NS	MD	UC	UC	MD*	UC	UC	UC	UC	UC
16	Product Classifier		NS	UC	UC	UC	MD*	UC	UC	UC	UC	UC
17	CA 1&2		NS	UC	UC	UC	MD*	UC	UC	MD	UC	MD
18	BO-1		NS	UC	UC	UC	MD*	UC	UC	UC	UC	MD*

AQD	Name	Year	1979	1981	1984	1986	1990	1990	1992	1995	1996	
		Permit	234	234A	234A2	643A	117	132	946	229	282	New
19	BO-2		NS	UC	UC	UC	MD*	UC	UC	UC	UC	MD*
20	Gas & Diesel Storage		NS	UC	UC	UC	UC	UC	UC	UC	UC	UC
21	Fuel Oil #2 Storage		NS	UC	UC	UC	UC	UC	UC	UC	UC	UC
23	Leach Tank				AD	UC	UC	UC	UC	DL	----	----
24	Boiler Fly Ash Silo				AD	UC	UC	UC	UC	UC	UC	UC
25	AT Crush and Screen					AD	MD*	UC	UC	UC	UC	UC
26	AT Dryer					AD	MD*	UC	UC	UC	UC	UC
27	AT Bagging & Loadout					AD	MD*	UC	UC	UC	UC	UC
28	Fluid Bed Dryer						NS	UC	UC	UC	UC	UC
29	Pre-Primary Leach Tank						NS	UC	UC	DL	----	----
30	Lime Bin #1						NS	UC	UC	UC	UC	UC
31	Lime Bin #2						NS	UC	UC	UC	UC	UC
32	Caustic Evaporator						NS	UC	UC	UC	UC	UC
33	Sulfur Burner						NS	UC	UC	UC	UC	UC
34	Caustic Crystallizer						NS	UC	UC	UC	UC	UC
35	Sulfite Dryer						NS	UC	UC	UC	UC	UC
36	Sulfite Bin #1						NS	UC	UC	UC	UC	UC
37	Sulfite Bin #2						NS	UC	UC	UC	UC	UC
38	Sulfite Bin #3						NS	UC	UC	UC	UC	UC
39	Sulfite Bin #4						NS	UC	UC	UC	UC	UC
40	Sulfite Bagging						NS	UC	UC	UC	DL	----
41	Sulfite Loadout						NS	UC	UC	UC	UC	MD*
42	HCl Tank						NS	UC	UC	UC	UC	UC
43	Sulfur Storage Tank						NS	UC	UC	UC	UC	UC
44	Lime Unloading						NS	UC	UC	UC	UC	UC
45	AT Transloading						NS	NS	UC	UC	UC	UC
46	Trona Transfer							NS	UC	UC	UC	MD*
47	Exp Crusher							NS	UC	UC	UC	MD*
48	CA-3							NS	UC	UC	UC	MD
49	Leach Tank							NS/DL	----	----	----	----
50	Dryer Area							NS	UC	UC	UC	MD*
51	DR-5							NS	UC	UC	UC	UC
52	Silo Top #2							NS	UC	UC	UC	UC
53	Silo Bottom #2							NS	UC	UC	UC	MD*
54	T-200 Silo									NS	UC	UC
55	Ore Recycle/Reclaim								NS	UC	UC	UC
56	Gas-Fired Calciner								NS	DL	----	----
57	Transfer #2								NS	DL	----	----
58	Transfer #1								NS	DL	----	----
59	Transfer #3								NS	DL	----	----
60	Silo Bottom								NS	DL	----	----
61	Product Load Out								NS	DL	----	----
62	Carbon Silo									NS	UC	UC

AQD	Name	Year	1979	1981	1984	1986	1990	1990	1992	1995	1996	
		Permit	234	234A	234A2	643A	117	132	946	229	282	New
63	Perlite Silo									NS	UC	UC
64	Sulfite Blending #2										NS	UC
65	Sulfite Blending #1										NS	UC
66	Carbon/Perlite Scrubber										NS	UC
67	Bottom Ash										NS	UC
68	Bagging Trona Silo										NS	UC
70	Bagging Sulfite Silo										NS	UC
71	Bagging MBS Silo										NS	UC
72	MBS Soda Ash Feed										NS	UC
73	MBS Dryer										NS	UC
74	North Headframe											NS
75	Primary Crushing											NS
76	Primary Screening											NS
77	Transfer 101											NS
78	Transfer 102											NS
79	Transfer Point											NS
80	Calciner #4 ESP											NS
81	Product Dryer Area											NS
82	Dryer #6 ESP											NS
83	Silo Top											NS
84	Silo Bottom											NS
85	Boiler #3											NS

KEY TO ABBREVIATIONS:

NS = New Source

UC = Unchanged

DL = Deleted

AD = Added

MD = Modified

MD* = Limit modified to more closely reflect actual emissions

2.1.1 CT-234, CT-234A, CT-234A2, and OP-154

Solvay Soda Ash Joint Venture (previously Tenneco Oil Company, Tenneco Minerals Company, and Tenneco Soda Ash Joint Venture) received a WDEQ/AQD permit to construct (CT-234) an underground trona ore mine and a surface soda ash processing facility on July 2, 1979 for a soda ash production capacity of 1.0 MM TPY. The mine and surface facilities are located in the NE 1/4 of Section 31, T18N, R109W, six miles east-southeast of Little America, Wyoming and sixteen miles west-southwest of Green River, Wyoming (see Figure 2-1). Since the WDEQ did not have PSD review authority during

the initial permitting, a PSD permit was issued by the Environmental Protection Agency (EPA) Region VIII on October 5, 1979. The next permitting activity occurred with the issuance of WDEQ/AQD Permit CT-234A which allowed a modification of the air classifier stack by reducing design air volume and the stack height. In 1983, the permit was again revised, CT-234A2, to extend the life of the temporary trona ore stockpile to the end of 1985, and to more closely reflect actual operations and emissions. Since the net effect of these emission source changes was below de minimis levels and on-site air quality monitoring indicated ambient pollutant concentrations well below applicable state air quality standards, the formal impact analysis was not amended. An operating permit, OP-154, was issued on January 20, 1986.

2.1.2 CT-643, CT-643A, and OP-181

The next permitting activity occurred in 1985 with the proposed addition of the Alkaten® production facility with annual production capacity of 56,000 TPY. Three new emission point sources were identified, the emission rates indicated net increases triggering PSD review. On this basis, a PSD permit for construction of a major modification to a major stationary source was issued, CT-643, on September 16, 1985 by the WDEQ/AQD. As final design progressed, an entirely different type of process equipment was incorporated which required a revision of the emission scenario described in CT-643. Particulate emissions from the modified Alkaten® facility were significantly less than originally estimated in CT-643 and a revised permit not requiring PSD review was prepared and submitted. The WDEQ/AQD subsequently issued Permit CT-643A on July 29, 1986. After construction, compliance sampling data indicated that air flow characteristics of the three new permitted sources differed from that originally estimated, resulting in a discrepancy between permitted and actual emission rates. Adjustments to estimated allowable emission rates were made, resulting in an insignificant increase of total particulate emissions over that estimated in Permit CT-643A. These changes were then incorporated in an operating permit, OP-181, issued by WDEQ/AQD on February 25, 1988.

2.1.3 MD-117 and OP-257

The next permit modification, designated as MD-117, was approved by the WDEQ/AQD on February 28, 1990 for construction of a de-bottlenecking operation to increase soda ash production and the addition of a caustic/sulfite plant. The soda ash production increased from 1.0 MM TPY to 1.25 MM TPY, and the caustic/sulfite plant was permitted at an annual caustic (NaOH) production of 75,000 TPY and annual sulfite (Na_2SO_3) production rate of 50,000 TPY. Since increases in particulate matter emissions triggered PSD review, those emission sources associated with the Alkaten® bagging facility were considered as part of this PSD permit modification.

As part of the review process for MD-117, particulate emission limits of a number of existing emission sources were adjusted to more accurately reflect source-tested emissions, rather than the allowable emission estimates obtained from the New Source Performance Standard (NSPS) Subpart OOO of 0.02 gr/dscf. These adjusted particulate emission rates, based on adding 20-40 percent to the highest source-tested emission rate, were significantly below the estimated allowable particulate emission rates. However, these lowered particulate emission rates were not used as a credit, per EPA recommendation, against particulate emission increases from the new and modified sources associated with the de-bottlenecking and caustic/sulfite operations. In addition, particulate emission rates estimated for the new and modified sources were based on either vendor guaranteed values or the NSPS value of 0.02 gr/dscf. In the process of adjusting particulate emission rates for the existing emission sources, AQD #s 1, 3a, 3b, 3c, 8 and 9 were deemed to have no air emissions. The baghouses controlling these sources were found to be unnecessary, since there were virtually no emissions at these points to be controlled. Therefore, these sources were eliminated from further ambient air quality impact consideration. These emission points were never included as a credit in future permit applications, since they never had actual emissions. In addition, source AQD #4 was eliminated since the temporary ore stockpile no longer existed. The operating permit for this project, OP-257, was issued by WDEQ/AQD on November 9, 1995.

2.1.4 MD-132 and OP-258

The next permit modification, designated as MD-132, was approved by the WDEQ/AQD on November 30, 1990 to modify operations to increase soda ash production by 750,000 TPY for a total plant soda ash production rate of 2.0 MM TPY. Since increases in particulate matter and NO_X emissions triggered PSD review, those emission sources associated with the soda ash production expansion were considered as part of a PSD permit modification. Since the designation of a NO_X increment and baseline date of February 8, 1988 were recent occurrences, only the new and modified sources associated with the soda ash production expansion were required to be included as part of a NO_X increment consumption analysis.

During permit review, it was realized that there would be no emissions from AQD #49, the leach tank, due to a modification that eliminated those originally proposed emissions. An evaluation of NO_X emissions from the new calciner (AQD #48) based on Best Available Control Technology (BACT) review, resulted in an estimate of NO_X emissions of 30.6 lb/hr, based on the selected vendor guarantee estimate of 0.18 lb/MM Btu at 170 MM Btu/hr. The operating permit for this project, OP-258 was issued on November 9, 1995 by WDEQ/AQD.

A modification to MD-132 to address recently identified VOC emissions was submitted to WDEQ/AQD on February 15, 1996. Through testing, it has been determined that VOC emissions are emitted during the mining and processing of trona ore. This permit is still under review by the WDEQ/AQD.

2.1.5 CT-946

Permit CT-946 was issued on March 17, 1992 for the conversion of 1.5 MM TPY of trona ore to calcined trona. The proposed project triggered PSD permit requirements for PM_{10} emissions at 94.3 TPY and NO_X emissions at 166.4 TPY. A de minimis level of 42.3 TPY of CO emissions was also proposed. This project was never built. The permit and its

associated emissions were relinquished during the next permitting action (MD-229), except for AQD #55, the recycle/reclaim baghouse. This source was built, with PM_{10} emissions permitted at 0.4 pounds per hour (PPH), 1.75 TPY. The relinquished emissions associated with CT-946 will not be used as offsets to future emission increases.

2.1.6 MD-229

The next permit modification, the conversion of the two original calciners from coal to natural gas firing with an increase of soda ash production from 2.0 to 2.4 MM TPY, designated as MD-229, was issued on June 13, 1995. This project resulted in a significant net NO_x emissions reduction and did not trigger significant levels of other criteria pollutants, so PSD permitting was not required. Low emissions burners (0.05 lb NO_x/MM Btu) were installed in place of the original calciners' coal furnaces. This resulted in a reduction of the allowable NO_x emission rate of the two calciners' common stack, AQD #17, from 300 PPH (1,314 TPY) to 20 PPH (87.6 TPY). This is a reduction of permitted NO_x emissions of 280 PPH (1,226.4 TPY). Actual average emissions for the two years prior to the project were 684.5 TPY, therefore, the "actual to potential" decrease was 596.9 TPY. Three other sources were eliminated due to the conversion to gas: AQD #s 12, 23, and 29. Two small silo baghouses, AQD #s 62 and 63, with particulate emissions of 0.13 PPH (0.57 TPY) and 0.17 PPH (0.74 TPY) respectively, were previously constructed under a permit waiver. These sources were included in this permit. The permitted PM_{10} reductions associated with this permit were 9.7 PPH (42.5 TPY). The annual emission reductions "actual to potential" associated with MD-229 are summarized in Table 2-2 below:

Table 2-2: MD-229 PSD Emissions

AQD #	PM_{10}	NO_x
12	-0.08	
17	-16.87	-596.89
23	-0.89	
29	-1.08	
62	0.57	
63	0.74	
Total	-17.61 TPY	-596.89 TPY

2.1.7 MD-282

The most recent permit modification, MD-282, covers five small projects; 1) combir bagging, 2) an additional line in the sulfite plant to produce sodium metabisulfite, 3) f additional small housekeeping baghouses, 4) replacement of the third calciner bur AQD #48, with a low NO_X burner (the same 0.05 lb NO_X/MM Btu as installed on AQD # per MD-229), and 5) installation of steam tube dryers (AQD #15) sweep air preheate The increase in particulate emissions was offset by reductions associated with MD-2. as noted in Table 2-3 below. No other emission rates triggered a significant ra therefore, this permit was not required to address PSD requirements.

Table 2-3: MD-282 PSD Emissions and Netting

	PM_{10}	NO_X	SO_2
MD-229 (actual)	-17.6	-596.9	0
MD-282	23.6	16.2	3.4
Net PSD Increase	**6.0 TPY**	**16.2 TPY**	**3.4 TPY**
PSD Significant	15 TPY	40 TPY	40 TPY

NOTE: NO_X reductions from MD-229 were **not** used to offset NO_X increases during MD-282 permitting action.

2.2 EXISTING FACILITY

The existing facility consists of an underground trona ore mine with surface facilit which produce a number of products including soda ash, Alkaten®, caustic soda, sodil sulfite, and sodium metabisulfite. A description of each process follows. More deta can be found in the associated permit applications.

2.2.1 Existing Soda Ash Production Plant

The run-of-mine ore contains between 88 and 94 percent trona with impurities of she and shortite comprising the majority of the balance. Trona is a naturally occurri hydrated sesquicarbonate ($Na_2CO_3 \bullet NaHCO_3 \bullet 2H_2O$). Pure trona ore converts approximately 70 percent soda ash. The chemical equation is:

$$2Na_2CO_3 \bullet NaHCO_3 \bullet 2H_2O \leftrightarrow 3Na_2CO_3 + CO_2\uparrow + 5H_2O\uparrow.$$
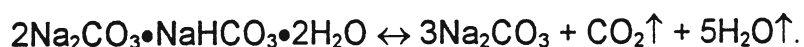
Basic ore processing procedures consist of crushing the ore, calcining the ore to drive off chemically bound water and carbon dioxide, dissolving the soda ash to leave behind insoluble impurities, filtering the resultant liquor, evaporating the excess water from the dissolved soda ash, dewatering the soda ash monohydrate crystals ($Na_2CO_3 \bullet H_2O$), drying and calcining the monohydrate to anhydrous soda ash (Na_2CO_3), and sizing for final shipment.

The run-of-mine ore passes through a primary crusher before being hoisted. The ore is again crushed and sized, then transported to either the processing units or to the enclosed ore storage building.

The calcination process occurs in rotary kilns as it is heated by combustion gases. The two original calciners were converted from coal to natural gas firing per MD-229. This process removes the water and carbon dioxide from the ore. The product of the calciners is a crude soda ash containing the impurities associated with the trona ore. This crude soda ash is mixed with a weak soda ash solution. The soluble soda ash is readily dissolved, with the resultant solution known as liquor. The insoluble impurities of shale, shortite, etc. are removed by thickeners, rakes, and filters and disposed of in the mine per WDEQ/Water Quality Division UIC Permit Number 96-201.

The resultant liquor is concentrated in evaporators by driving off water and precipitating sodium carbonate monohydrate crystals. A slurry of crystals is then drawn off. The crystals are separated and dried in either the original steam-tube dryers, the fluid bed dryer, or natural gas fired dryer. The final product is classified and conveyed to storage silos to await shipment either by rail, truck, or in bags.

Equipment of the existing soda ash facility includes an underground mine, surface ore handling facilities, a covered ore stockpile, a crushing facility, three chemical processing lines, product storage and shipping facilities, two 350 MM Btu/hr coal fired boilers, and a covered coal storage facility. Major processing equipment emission points include a

single stack exhausting the two original calciners, a stack for the third calciner, a single stack exhausting the two original dryers, a single stack each for the fluid bed dryer and natural gas fired product dryer, and the two boiler stacks. Other collection equipment is used throughout the plant for control of emissions from dry materials handling operations.

Detailed process and emission point identification drawings are included in Permits CT-234, CT-234A, CT-234A2, CT-643A, MD-117, MD-132, MD-229, and MD-282.

2.2.2 Alkaten® Production Plant

Alkaten® is a dried trona ore product. The production and bagging facility was started up in 1987 to provide an additional product from the mined trona ore. As described in Permit CT-643A, major equipment used to achieve a production rate of 56,000 TPY from a throughput of 112,000 TPY of trona ore includes a vertical shaft impact mill, a crushing and screening operation, a dryer, and a bagging and loadout facility. Detailed process and emission point identification drawings are included in CT-643 with appropriate revisions in CT-643A.

2.2.3 Caustic/Sulfite Plant

The caustic/sulfite plant is designed to produce 75,000 TPY (dry basis) of sodium hydroxide (NaOH) as a 50 percent solution and 50,000 TPY of dry sodium sulfite (Na_2SO_3) and related products.

The caustic/sulfite process is installed in two areas: 1) Leaching and solids removal in the existing soda ash process building, and 2) balance of processing in the caustic/sulfite plant area. Process flow sheets included as support documentation to MD-117 show this area division as well as the process steps required to produce the caustic and sulfite products. A brief description of the operations follows:

Crushed trona ore from the existing soda ash ore crushing facility is dissolved in water and caustic solution to produce a near saturated solution of soda ash. This solution is

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reacted with a milk-of-lime slurry, which is produced by mixing lime (CaO) with water. The resultant caustic solution is then thickened and separated from the waste solids. The solution is further filtered and evaporated, resulting in a 50 percent caustic (NaOH) solution. The caustic is stored and shipped in bulk.

The sulfite process begins with a soda ash solution, which is reacted with SO_2 gas, produced by burning molten sulfur. This solution is fed to an evaporator, where sodium sulfite (Na_2SO_3) crystals are formed. The crystals are dewatered and dried before storage and/or shipment.

The recent permit MD-282, allows the construction of an expansion to the sulfite plant to produce 20,000 TPY of sodium metabisulfite ($Na_2S_2O_5$). This product is made in a similar manner to sulfite. A variation in the pH of the solution after reacting with SO_2 will produce sodium metabisulfite (MBS). This project was recently completed.

2.2.4 Bagging Facility

The bagging facility, also permitted under MD-282 is currently under construction. It includes installation of seven silos which will accommodate soda ash, sodium sulfite, trona products, and MBS. These products will be bagged and palletized in the new facility. Baghouses are being installed to control the dust emissions associated with the project.

2.3 SODA ASH EXPANSION

The currently proposed soda ash expansion will be constructed adjacent to the existing facility, on previously disturbed private lands. This expansion is similar to the previous expansion permitted under MD-132/OP-258. It will consist of a fourth soda ash production line, with the ability to produce an additional 1.2 MM TPY of soda ash, resulting in a total permitted annual production rate of 3.6 MM TPY. Furthermore, the three existing calciners will be modified to increase their throughput to 200 TPH each. This will allow more flexibility in calciner operation, while maintaining final soda ash production capability at 3.6 MM TPY.

Major equipment included in the project are a new covered ore storage building, an expansion of the existing crushing facility, the addition of a new primary crushing and screening facility, a 400 MM Btu/hr natural gas fired calciner with associated dissolving, filtering, and evaporating equipment, a 200 MM Btu/hr natural gas fired dryer, a 100 MM Btu/hr natural gas fired industrial boiler, and two new silos. The existing mine ventilation shaft will be converted to a production shaft, requiring the construction of a new mine ventilation shaft for return air. The main purpose of the new industrial boiler will be to heat the mine ventilation air. Ancillary facilities include various storage tanks. Particulate emissions from the calciner and dryer will be controlled by electrostatic precipitators (ESPs). The dust generated from ore and dry product handling will be controlled by baghouses or similar dust collection devices. NO_x, CO, and VOC emissions from the natural gas fired units will be controlled by the design of the burners. Additional CO and VOC emissions may be emitted from the calciner due to the incomplete combustion of the organics inherently associated with the trona ore. Low concentrations of some hazardous air pollutants (HAPs) are included in the VOCs.

2.4 SODA ASH EXPANSION CONSTRUCTION AND OPERATION SCHEDULE

Solvay Soda Ash Joint Venture plans to begin construction of the expansion project in September, 1997. The project will be completed in three phases, with each phase allowing the production of 400,000 TPY of soda ash, a total increase of 1.2 MM TPY. However, the majority of the equipment will be installed during the first phase. This will include the calciner, dryer, boiler, and associated equipment. The second phase will consist of construction of the additional covered ore storage facility and additional crushing and screening capacity. The third phase will consist mainly of the installation of additional evaporative capacity. Completion of the first phase is scheduled for June, 1999, with the second and third phases following in January, 2001 and January, 2003.

Modification to the existing calciners, mainly consisting of the installation of a bucket elevator in place of the existing drag conveyor at the outlet of each calciner, will allow an

increase of ore throughput capacity to 200 TPH for each calciner.

All sources will be permitted to operate continuously, 8,760 hours per year at the maximum design rate.

2.5 REGULATORY REQUIREMENTS

The proposed modifications to the Solvay Soda Ash Joint Venture facility have been reviewed to assess regulatory requirements and applicability. Based on this assessment, the proposed modifications are subject to the requirements of WAQS&R Sections: 10 - Nitrogen Oxides, 21 - Permit Requirements, 24 - Prevention of Significant Deterioration, and 30 - Operating Permits. New Source Performance Standards (NSPS) found in 40 CFR Part 60 and WAQS&R Section 22 are applicable to the new and modified sources. Subpart OOO - Standards of Performance for Nonmetallic Mineral Processing Plants, addresses particulate emissions; while Subpart Dc - Standards for Performance for Small Industrial-Commercial-Institutional Steam Generating Units, addresses emissions from the proposed 100 MM Btu/hr boiler.

As a result of the proposed modifications, specific PSD permitting requirements set forth in WAQS&R Section 24 are triggered by the anticipated increases in PM_{10}, CO, and VOC emissions, detailed in Section 3.0. The increase in NO_X emissions is offset by contemporaneous NO_X emission reductions.

The permit requirements specify that emissions from the existing facility and the proposed modifications do not cause or contribute to a violation of ambient air quality standards or PSD increments. In addition, for an existing facility defined as a major stationary source, any air pollutants with an increase in actual emissions exceeding the significance level in Table 2-4 trigger a Best Available Control Technology (BACT) analysis for those sources and pollutants. WDEQ/AQD requires BACT analysis of all emission sources, regardless of the magnitude of emissions. Sources that trigger BACT analysis due to being above significance levels, must also be assessed to determine

PSD applicability. Table 2-1 summarizes the permitting history of all existing, modified, and proposed regulated emission sources. Based on the emissions inventory presented in Section 3.0, the proposed modifications will trigger a BACT analysis for PM_{10}, CO, and VOC with a PSD increment analysis required for PM_{10}. NO_x emission increases do not trigger PSD increment analysis due to the ability to net emission reductions associated with Permit MD-229.

Table 2-4: Significant Emission Rates

40 CFR 52.21 (b) (23)

Pollutant	Emission Rate (ton/year)
Carbon monoxide (CO)	100
Nitrogen oxides (NO_x)	40
Sulfur dioxide (SO_2)	40
Particulate matter (total suspended - TSP)	25
Particulate matter (diameter of <10 microns - PM_{10})	15
Ozone (VOC)	40 (of VOCs)
Lead	0.6
Asbestos	0.007
Beryllium	0.0004
Mercury	0.1
Vinyl chloride	1
Fluorides	3
Sulfuric acid mist	7
Hydrogen sulfide (H_2S)	10
Total reduced sulfur (including H_2S)	10
Reduced sulfur compounds (including H_2S)	10
Any other pollutant regulated under the CAA	Any emission rate
Each regulated pollutant	Emission rate that causes an air quality impact of 1 $\mu g/m^3$ or greater (24-hour basis) in any Class I area located within 10 km of the source

An assessment of the impacts of expected emission increases from the facility will be made on Air Quality Related Values (AQRVs); visibility, waters (lake chemistry), vegetation, and soils. A more appropriate model for assessing the long range effects of emissions on visibility and lake chemistry is currently being developed via the Southwest Wyoming Technical Air Forum (SWWTAF). For purposes of this permit application, these impacts will be assessed utilizing currently available models.

Any facility that emits more than 10 TPY of any single HAP, or more than 25 TPY of any combination of HAPs is considered a major source for HAPs. A complete emissions inventory of HAPs is included in Section 3.0, as requested by WDEQ/AQD. Modeling to assess ambient impacts of the HAPs was conducted, and results compared to standards set forth in various states throughout the nation.

The Section 30 Operating Permit will be updated within twelve months of commencement of the project.
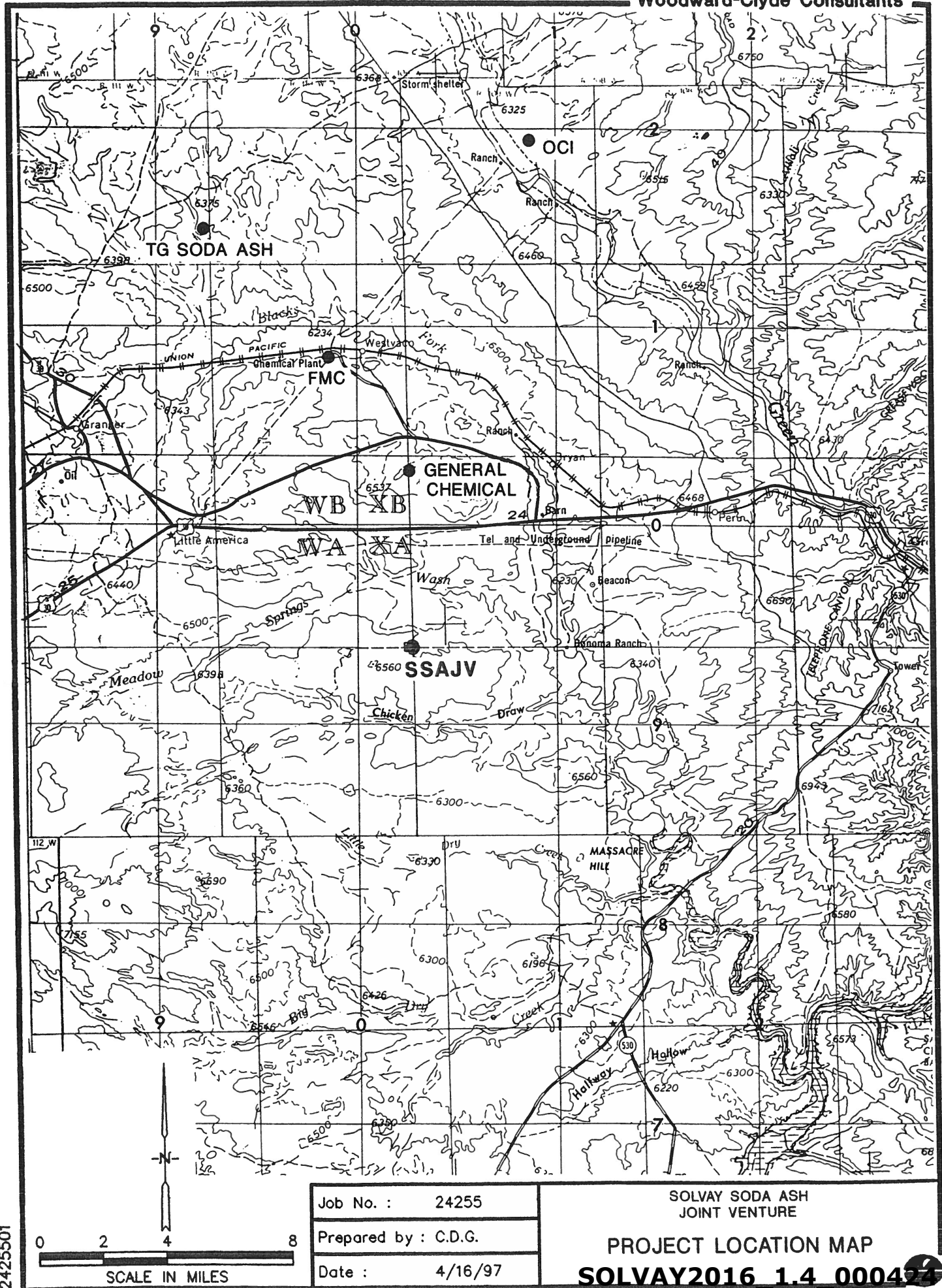
SOLVAY SODA ASH
JOINT VENTURE

PROJECT LOCATION MAP

Job No. :	24255
Prepared by : C.D.G.	
Date :	4/16/97

SCALE IN MILES

0   2   4   8

-N-

2425501

SOLVAY2016_1.4_000424

FIG. 2-1

3. EMISSIONS INVENTORY

This section provides a description of the emissions inventory for the existing facility with proposed modifications and applicable background emission sources. In addition, a BACT analysis is included for new and modified sources. The applicable NSPSs for this facility are Subpart OOO - Standards of Performance for Nonmetallic Mineral Processing Plants from 40 CFR 60.670 and Subpart Dc - Standards of Performance for Industrial Boilers from 40 CFR 60.40. As presented in the BACT analysis, all new particulate emission sources within the soda ash production facility will meet or exceed the NSPS emission limitation of 0.05 grams/dry standard cubic meter (0.02 grains/dry standard cubic foot). Subpart Dc addresses steam generating units with a maximum heat input capacity of 100 MM Btu/hr, however, emission standards for natural gas fired units are not specified.

3.1 EXISTING FACILITY WITH PROPOSED MODIFICATIONS

The proposed modifications to the existing soda ash facility will result in an increase in PM_{10} emissions of 106 TPY, CO emissions of 6,576 TPY, VOC emissions of 3,298 TPY, and SO_2 emissions of less than 1 TPY. NO_X emission will increase by 260.4 TPY, but these are offset by an "actual" NO_X emissions reduction of 596 TPY as noted in Table 2-2: MD-229 PSD Emissions. The PSD net emissions changes (including emissions from MD-229 and MD-282 which have not been addressed by a PSD permit analysis) are tabulated below and compared to PSD significant rates. As noted, PM_{10}, CO, and VOC emission rates trigger PSD permit review:

Table 3-1: PSD Net Emissions Changes

(Tons Per Year)

	PM_{10}	CO	VOC	SO_2	NO_X
(PSD Incremental Emissions Covered by a Current Permit) MD-229 MD-282	 6.0	 0.0	 0.0	 3.4	 -596.9 +16.2
Expansion	106.0	6575.6	3299.3	0.3	268.5
Total	**112.0**	**6575.6**	**3299.3**	**3.7**	**-312.2**
Significant Level	15	40	100	40	40
Exceed Significant Level?	**Yes**	**Yes**	**Yes**	**No**	**No**

3.1.1 Air Toxics Emissions

Numerous tests have been conducted at the SSAJV facility to quantify VOC emissions (non-methane/ethane hydrocarbons) and to speciate and quantify hazardous air pollutants (HAPs). Only recently, VOC and HAP emissions have been identified as being emitted from the trona ore, especially during calcination of the ore. The stack testing methods to speciate and quantify HAPs have evolved in these few years of testing. Following is a brief discussion of the testing methods used.

3.1.1.1 HAP Testing Review

3.1.1.1.1 Methods SW-846 0010 and 0030

During 1994 and early 1995, EPA Methods 0010 and 0030 were conducted on SSAJV's existing calciner stacks (AQD #s17 and 48). These methods involve capturing the stack gas in various cartridges, transporting them to a laboratory, and then extracting the captured compounds onto a gas chromatograph (GC). Results of the 0010 for semi-volatiles revealed nearly insignificant emission rates, with the highest concentration in the range of only hundredths of a ppm. The 0030 testing for volatiles resulted in higher concentrations, so future testing has focused on these volatile organic emissions.

3.1.1.1.2 EPA Method 18

To more accurately quantify the HAP emissions, it was decided to do additional testing utilizing EPA Method 18, focusing on the volatiles identified in the 0030 testing. During 1995, stack samples were collected in Tedlar® bags, and then transported to a laboratory for analysis on a GC. Problems arose, with some tedlar bags leaking during transit to the laboratory, as well as degradation of some of the compounds.

3.1.1.1.3 On-site Method 18

To alleviate the Tedlar® bag leakage problem, the next level of testing was done utilizing EPA Method 18 with a GC on-site. Stack gases were injected directly into the GC from a heated sample line. This method of testing for HAPs was first conducted during December, 1995.

Some of the tests utilizing Method 18 identified chlorinated compounds, including methylene chloride, 1,1,1-trichloroethane, and trichloroethene, as well as acrylonitrile. These compounds were not found in every test run. Since the presence of chlorinated compounds was suspicious, during the July 1996 testing, two GCs were utilized; one with a column specifically designed to detect methylene chloride. This was done to more accurately differentiate the compounds. During this round of testing, methylene chloride was not detected.

3.1.1.1.4 Boiler and Industrial Furnace (BIF) EPA Method 0011

To further analyze for HAPs which are not detected by the GC, the Boiler and Industrial Furnace (BIF) EPA Method 0011 was utilized during December 1995 and July 1996. This test method identifies aldehydes and ketones.

3.1.1.1.5 On-site GC/MS - Direct Interface

The most recent HAP testing conducted at the SSAJV facility, during November 1996, utilized a Gas Chromatograph/Mass Spectrometer (GC/MS). The stack gases were directly injected into the GC/MS from a heated sample line. The GC/MS not only allows separation of compounds by the retention time associated with the GC, but also separates compounds by their mass spectra. This twofold separation allows a very specific, accurate identification of compounds. The GC/MS did not identify any chlorinated compounds or acrylonitrile in the calciner stack gases, which had previously been identified by the GC. SSAJV believes the identification of these compounds by the GC may have been a testing inaccuracy or laboratory artifact. As noted above, testing during July 1996 utilized two on-site GCs, one with a column specific to methylene chloride. Methylene chloride was not detected. Even so, the emission rates of the chlorinated compounds obtained by the GC testing during December 1995, have been analyzed for ambient impacts. Estimated HAP emissions from the calciners are included in Tables 3-2, 3-3, and 3-4.

Table 3-2 summarizes EPA Method SW846 0010 - Semi-Volatile HAPs. This test was conducted in August 1994. The results are reported as pounds per ton of ore. This emission factor is then multiplied by the maximum ore tonnage rate (TPH) to determine the PPH emission rate of each of the three calciner sources (AQD #s 17, 48 and 80).

Table 3-2: EPA Method 0010 Semi-Volatile Organic HAPs

Compounds	AQD #48	AQD #17	AQD #48	AQD #80
Units	PPT	PPH	PPH	PPH
Comments	Aug '94 Test	@ 400 TPH	@200 TPH	@275 TPH
Acetophenone	0.0000399	0.0160	0.0080	0.0110
Biphenyl	0.0000570	0.0228	0.0114	0.0157
bis(2-Ethylhexyl)phthalate	0.00000385	0.0015	0.0008	0.0011
2-Chloroacetophenone	0.00000349	0.0014	0.0007	0.0010
3/4 Methylphenol	0.0000233	0.0093	0.0047	0.0064
Cumene	0.00000443	0.0018	0.0009	0.0012
Dibenzofuran	0.0000477	0.0191	0.0095	0.0131
Di-n-butylphthalate	0.0000288	0.0115	0.0058	0.0079
N,N-Dimethylaniline	0.0000191	0.0076	0.0038	0.0052
Naphthalene	0.000369	0.1477	0.0739	0.1016
Phenol	0.000227	0.0907	0.0453	0.0623

Table 3-3 summarizes EPA Method 0011 - Aldehydes and Ketones. A statistical analysis of the stack test results was conducted to derive both the expected average and maximum hourly emissions. First, the average of the tests for each calciner is calculated, when this is multiplied by the maximum hourly tonnage rate, the result is "average" PPH. When 3 times the standard deviation of the test results is added to the average of the tests, the result is the "maximum" expected hourly emission rate. This result has a confidence level of 99.7 percent. This too, is multiplied by the maximum hourly tonnage rate to determine maximum PPH. The table notes the test results conducted during December 1995 and July 1996 on both calciner stacks (AQD #s 17

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and 48). The average of the tests on both sources is applied to the new calciner source (AQD #80) for expected emission rates. The PPH rate is determined as explained above.

Table 3-3: EPA Method 0011 Aldehydes and Ketones

Test Results - Pounds per Ton of Ore						
Source	AQD #17	AQD #48	Both	AQD #17	AQD #48	Both
Comments	Average Tests	Average Tests	Average Tests	Ave & 3(Std Dev)	Ave & 3(Std Dev)	Ave & 3(Std Dev)
Compounds	PPT	PPT	PPT	PPT	PPT	PPT
Formaldehyde	0.00075	0.0002	0.000475	0.000962	0.000624	0.001466
Acetaldehyde	0.00065	0.00055	0.0006	0.002983	0.001186	0.002007
Propionaldehyde	0.0002	0.00015	0.000175	0.001049	0.000362	0.000687
Acrolein	0.0018	0.00135	0.001575	0.004346	0.001562	0.003243
Acetone	0.0006	0.0003	0.00045	0.003146	0.001573	0.002173
2-Butanone	0.0003	0.00015	0.000225	0.001573	0.000786	0.001087
Expected Emissions - Pounds per Hour						
Source	AQD #17	AQD #48	AQD #80	AQD #17	AQD #48	AQD #80
Production Rate	400 TPH	200 TPH	275 TPH	400 TPH	200 TPH	275 TPH
	Average	Average	Average	Maximum	Maximum	Maximum
Compounds	PPH	PPH	PPH	PPH	PPH	PPH
Formaldehyde	0.30	0.04	0.13	0.38	0.12	0.26
Acetaldehyde	0.26	0.11	0.17	1.19	0.24	0.82
Propionaldehyde	0.08	0.03	0.05	0.42	0.07	0.29
Acrolein	0.72	0.27	0.43	1.74	0.31	1.20
Acetone	0.24	0.06	0.12	1.26	0.31	0.87
2-Butanone	2-Butanone results from Method 18 used for modeling					

Average emission rate calculation: Average PPT X Maximum Production Rate TPH = Average PPH

Maximum emission rate calculation: (Average + 3(Std Dev) PPT) X Maximum Production Rate TPH = Maximum PPH.

For proposed AQD #80, used average of AQD #s 17 and 48 test results.

Table 3-4 summarizes the average of EPA Method 18. The tests conducted during December 1995 and July 1996 utilized the GC, and the November 1996 test utilized the GC/MS. Table 3-4 notes average and maximum expected emission rates, calculated as explained above. 1,1,1-trichloroethane, acrylonitrile, methylene chloride, and

trichloroethene were not identified during the GC/MS testing. It is believed that these compounds were misidentified on the GC.

Table 3-4: EPA Method 18 HAPs

Test Results - Pounds per Ton of Ore						
Source	AQD #17	AQD #48	Both	AQD #17	AQD #48	Both
	Average of Tests	Average of Tests	Average of Both	Ave & 3(Std Dev)	Ave & 3(Std Dev)	Ave & 3(Std Dev)
Compounds	PPT	PPT	PPT	PPT	PPT	PPT
Benzene	0.02785	0.033233	0.030542	0.062659	0.053045	0.059023
1,3 Butadiene	0.018875	0.0253	0.022088	0.129729	0.15469	0.130858
Ethyl Benzene	0.00425	0.0024	0.003325	0.015374	0.008664	0.012477
2-Butanone	0.00945	0.0037	0.006575	0.049054	0.013314	0.036576
Hexane	0.0089	0.010167	0.009533	0.036768	0.034506	0.033822
Styrene	0.00515	0.005967	0.005558	0.014907	0.020889	0.016673
Toluene	0.013975	0.0123	0.013138	0.033219	0.017015	0.027272
Xylene	0.01915	0.0159	0.017525	0.05651	0.038883	0.047543
*1,1,1-Trichloroethane	0.00545	0.0142	0.009825	0.028572	0.02014	0.030311
*Acrylonitrile	0.0026	0.00145	0.002025	0.013631	0.007602	0.009584
*Methylene Chloride	0.0006	0.0018	0.0012	0.003146	0.009437	0.006291
*Trichloroethene	0.01955	0.0058	0.012675	0.095705	0.018952	0.063252
Expected Emissions - Pounds per Hour						
Source	AQD #17	AQD #48	AQD #80	AQD #17	AQD #48	AQD #80
Production Rate	400 TPH	200 TPH	275 TPH	400 TPH	200 TPH	275 TPH
	Average	Average	Average	Maximum	Maximum	Maximum
Compounds	PPH	PPH	PPH	PPH	PPH	PPH
Benzene	11.14	6.65	8.40	25.06	10.61	17.23
1,3 Butadiene	7.55	5.06	6.07	51.89	30.94	35.68
Ethyl Benzene	1.70	0.48	0.91	6.15	1.73	4.23
2-Butanone	3.78	0.74	1.81	19.62	2.66	13.49
Hexane	3.56	2.03	2.62	14.71	6.90	10.11
Styrene	2.06	1.19	1.53	5.96	4.18	4.10
Toluene	5.59	2.46	3.61	13.29	3.40	9.14
Xylene	7.66	3.18	4.82	22.60	7.78	15.54
*1,1,1-Trichloroethane	2.18	2.84	2.70	11.43	4.03	7.86
*Acrylonitrile	1.04	0.29	0.56	5.45	1.52	3.75
*Methylene Chloride	0.24	0.36	0.33	1.26	1.89	0.87
*Trichloroethene	7.82	1.16	3.49	38.28	3.79	26.32

* These four compounds, 1,1,1-Trichloroethane, acrylonitrile, methylene chloride, and trichloroethene were only identified during some of the GC tests, not during the GC/MS testing. SSAJV believes these compounds were misidentified on the GC, the GC/MS is more accurate in identifying compounds. See text for more details.
Average , maximum and AQD #80 emission rates calculated as explained after Table 3-3.

SSAJV has completed one round of tests for HAPs utilizing the GC/MS on the mine exhaust. Therefore, average and maximum emission rates are assumed to be the same. These emission rates are depicted in Table 3-5.

Table 3-5: Mine Vent Exhaust HAP Emissions

Compound	PPH	TPY
Benzene	0.29	1.29
2-Butanone	0.77	3.39
Hexane	0.43	1.87
Styrene	0.08	0.35
Toluene	2.51	10.98
Xylene	8.67	37.96

A table of the CAS Numbers associated with the HAP compounds can be found in the Table of Contents Section.

3.1.2 Basis of Source Emissions Estimates

Several new stationary emission sources will be constructed as part of the soda ash expansion project. These sources include: a natural gas fired calciner, natural gas fired dryer, crusher and screening equipment, product sizing and transfer equipment, silos, and a natural gas fired industrial boiler. Emission rates are either vendor guaranteed, estimated from factors in EPA AP-42 Table 1.4-1, October 1986 version, or estimated from stack testing of existing sources. A table summarizing the applicable emission factors, design information, hourly emission rates, and basis of emission estimates for each new source is presented in Table 3-6.

Table 3-6: Basis of Emission Rates for Expansion Sources

Emission Point	Pollutant	Emission Rate	Design Information	Emission PPH	Basis of Estimate
AQD #74	PM_{10}	0.01 gr/dscf	4,000 dscfm	0.34	Vendor guarantee
AQD #75	PM_{10}	0.01 gr/dscf	4,000 dscfm	0.34	Vendor guarantee
AQD #76	PM_{10}	0.01 gr/dscf	43,150 dscfm	3.70	Vendor guarantee
AQD #77	PM_{10}	0.01 gr/dscf	2,600 dscfm	0.22	Vendor guarantee
AQD #78	PM_{10}	0.01 gr/dscf	3,200 dscfm	0.27	Vendor guarantee
AQD #79	PM_{10}	0.01 gr/dscf	2,400 dscfm	0.21	Vendor guarantee
AQD #80	PM_{10}	0.015 gr/dscf	92,750 dscfm	11.93	Vendor guarantee
	NO_x	0.05 lb/MM Btu	400 MM Btu/hr	20.00	Vendor guarantee
	CO	3.81 PPT	275 $tons_{ore}$/hr	1048	Testing
	VOC	1.94 PPT	275 $tons_{ore}$/hr	534	Testing
AQD #81	PM_{10}	0.01 gr/dscf	20,250 dscfm	1.74	Vendor guarantee
AQD #82	PM_{10}	0.01 gr/dscf	47,555 dscfm	4.08	Vendor guarantee
	NO_x	0.15 lb/MM Btu	200 MM Btu/hr	30.00	Vendor guarantee
	CO	0.07 lb/MM Btu	200 MM Btu/hr	14.00	Vendor guarantee
	VOC	1.4 lb/MMft$^3_{gas}$	193,237 ft$^3_{gas}$/hr	0.27	AP-42 Table 1.4-1
AQD #83	PM_{10}	0.01 gr/dscf	3,350 dscfm	0.29	Vendor guarantee
AQD #84	PM_{10}	0.01gr/dscf	6,900 dscfm	0.59	Vendor guarantee
AQD #85	PM_{10}	5 lb/MMft$^3_{gas}$	96,618 ft$^3_{gas}$/hr	0.48	AP-42 Table 1.4-1
	NO_x	0.038 lb/MM Btu	100 MM Btu/hr	3.80	Vendor guarantee
	CO	0.09 lb/MM Btu	100 MM Btu/hr	9.00	Vendor guarantee
	VOC	2.8 lb/MMft$^3_{gas}$	96,618 ft$^3_{gas}$/hr	0.28	AP-42 Table 1.4-1
	SO_2	0.6 lb/MMft$^3_{gas}$	96,618 ft$^3_{gas}$/hr	0.06	AP-42 Table 1.4-1

Equipment downstream of the three existing calciners (AQD #s 17 and 48) will be replaced to provide additional production throughput. The basis for the expected emission rates following the modification are noted in the table below:

Table 3-7: Basis of Emission Rates for Modified Sources

Emission Point	Pollutant	Emission Rate	Design Information	Emission PPH	Basis of Estimate
AQD #17	PM_{10}	0.022 gr/dscf	120,424 dscfm	22.30	Testing/Estimate
	NO_X	0.05 lb/MM Btu	500 MM Btu/hr	25.00	Testing/Estimate
	CO	3.81 PPT	400 tons$_{ore}$/hr	1524	Testing
	VOC	1.94 PPT	400 tons$_{ore}$/hr	776	Testing
AQD #48	PM_{10}	0.018 gr/dscf	60,212 dscfm	9.34	Testing/Estimate
	NO_X	0.05 lb/MM Btu	250 MM Btu/hr	12.50	Testing/Estimate
	CO	3.81 PPT	200 tons$_{ore}$/hr	762	Testing
	VOC	1.94 PPT	200 tons$_{ore}$/hr	388	Testing

The existing baghouse (AQD #6b), will be eliminated by combining the pick-up points with an existing baghouse (AQD #53), which has excess capacity. The proposed fourth crusher line will have particulate emissions controlled by an existing baghouse, AQD #47. This baghouse was originally designed for this additional crusher. Furthermore, allowable PM_{10} emission rates on a number of existing baghouses and the existing boilers will be reduced to more closely reflect actual emissions. Discussion of these changes are detailed in Section 3.1.2.2 - Modification to Existing Sources.

3.1.2.1 New Sources

AQD #74 - North Headframe

Upon reaching the production shaft headframe, trona ore will be conveyed to the primary screen distribution bins. Further details can be found on the process flow diagram 000-PF-131 (see Dust Collection Points Numbers 1, 2, and 3). The particulate emissions will be controlled by the North Headframe Baghouse, with an air to cloth ratio of 4:1. This baghouse will meet an emission limit of 0.01 grains/dscf, resulting in a rate of 0.3 PPH

PM_{10}. Testing of existing ore handling sources reveals no detectable VOC or HAP emissions; therefore, it is assumed this source will not emit VOCs or HAPs.

AQD #75 - Primary Crushing

Dust generated in the primary crushing area will be controlled by the Primary Crushing Baghouse, with an air to cloth ratio of 4:1. Further details can be found on the process flow diagram 000-PF-131 (see Dust Collection Point Numbers 4, 5, and 6). An emission limit of 0.01 grains/dscf will be met, resulting in 0.03 PPH of PM_{10}. As noted above, no VOC or HAP emissions are expected.

AQD #76 - Primary Screening

Particulate emissions resulting from the transport of trona ore via belts from the primary screening area will be controlled by the Primary Screening Baghouse. Further details can be found on the process flow diagram 000-PF-131 (see Dust Collection Point Numbers 7 through 25). The baghouse will have a 4:1 air to cloth ratio. The emission limit will be 0.01 grains/dscf, resulting in a rate of 3.7 PPH of PM_{10}. As noted above, no VOC or HAP emissions are expected.

AQD #77 - Transfer 101

Dust generated from the conveying of the primary screen undersize material will be controlled by Transfer Baghouse 101. Further details can be found on the process flow diagrams 000-PF-131 and 000-PF-132A (see Dust Collection Point Numbers 26 and 27). The air to cloth ratio of the baghouse will be 4:1. The emissions will be controlled to a limit of 0.01 grains/dscf, resulting in a rate of 0.2 PPH of PM_{10}. No VOC or HAP emissions are expected.

AQD #78 - Transfer 102

The particulate emissions generated from the conveying of trona ore from the west reclaim will be controlled by Transfer Baghouse 102. Further details can be found on the process flow diagram 000-PF-131 (see Dust Collection Point Numbers 28 and 29).

The air to cloth ratio will be 4:1, meeting an emission limit of 0.01 grains/dscf, resulting in a rate of 0.3 PPH of PM_{10}. No VOC or HAP emissions are expected.

AQD #79 - Transfer Point

Dust generated on the west reclaim transfer conveyor will be controlled by a dust collector meeting an emission limit of 0.01 grains/dscf, resulting in a rate of 0.2 PPH of PM_{10}. Further details can be found on the process flow diagram 000-PF-132A (see Dust Collection Point Numbers 30 and 31). No VOC or HAP emissions are expected.

AQD #80 - Calciner #4

The natural gas fired calciner will convert raw trona ore to a crude soda ash through the calcination process in which CO_2 and H_2O are evolved. Particulate emissions will be controlled by an Electrostatic Precipitator (ESP) to a limit of 0.015 gr/dscf. The unit is designed at 92,751 dry standard cubic feet per minute (dscfm), resulting in an emission rate of 11.93 PPH or 52.25 TPY of PM_{10}. A low NO_X burner will be installed, resulting in emission rates of 0.05 lb NO_X/MM Btu and 0.07 lb CO/MM Btu. This 400 MM Btu/hr burner will emit 20 PPH of NO_X (87.6 TPY) and 28 PPH of CO (122.64 TPY).

Testing of the existing calciners has revealed CO, VOC, and HAP emissions due to the calcination of the trona ore. Due to the extreme variability and the limited number of samples, a very conservative approach to determine maximum emission rates of these pollutants was utilized. For CO and HAPs a statistical analysis of stack test results was done to derive the expected average and maximum hourly emission. First, the average result is calculated, then to it is added 3 times the standard deviation. Statistically, this result depicts the maximum hourly emission rate with a confidence level of 99.7 percent. Utilizing this statistical method, maximum CO emissions are estimated at 3.81 PPT as noted in Table 3-8.

Table 3-8: AQD #80 CO Emissions

Stack Test Results and
Statistical Analysis
(Pounds per Ton of Ore)

AQD #	17	48
Date	Oct-95	Apr-95
Run #1	3.066	0.618
Run #2	2.313	0.508
Run #3	2.470	0.455
Average	2.62	0.53
Std Dev	0.40	0.08
Ave + 3(SD)	**3.81**	0.78

With a maximum hourly production rate of 275 TPH, a maximum of 1,047.75 PPH, or 4,589 TPY of CO emissions are expected.

Estimated average HAP emission rates are summarized in Tables 3-2, 3-3, and 3-4. Concerning VOC emissions, the highest stack test result was used as the maximum emission factor of 1.94 PPT, the average of the stack test results was used as the average emission factor of 0.766 PPT as noted in the table below:

Table 3-9: AQD #80 VOC Emissions

Stack Test Results and Statistical Analysis

(Pounds per Ton of Ore)

Date Tested	AQD #17	AQD #48	Both
Jan-95	-	0.528	
Apr-95	-	0.349	
Oct-95	0.676	0.329	
Dec-95	0.458	0.520	
Jul-96	0.578	**1.94**	
Nov-96	1.483		
Average	0.799	0.733	**0.766**

At a production rate of 275 TPH, the maximum expected hourly emission rate is 533.5 PPH of VOC, the average expected hourly emission rate is 210.7 PPH. Process flow diagram 000-PF-133C reveals the layout of the calciner and ESP.

AQD #81 - Dryer Area

Particulate emissions due to the transfer and conveying of soda ash in the dryer area will be controlled by a baghouse meeting an emission limit of 0.01 gr/dscf, resulting in a rate of 4.08 PPH (17.87 TPY) of PM_{10} emissions. Further details can be found on the process flow diagram 000-PF-141D (see Dust Collection Point Numbers 33 through 42). The Dryer Area Baghouse will be designed at a 4:1 air to cloth ratio. No other pollutants are expected to be emitted.

AQD #82 - Dryer #6

The natural gas fired dryer will convert the sodium carbonate monohydrate to anhydrous sodium carbonate with the removal of free and molecular moisture. The average production rate will be 137 TPH, with a maximum instantaneous rate of 161 TPH, resulting in an annual soda ash production of 1.2 MM TPY from this unit. Particulate emissions will be controlled by an Electrostatic Precipitator (ESP) to a limit of 0.010 gr/dscf. The unit is designed at 47,555 dscfm, resulting in a emission rate of 4.08 PPH or 17.87 TPY of PM_{10}.

A flame grid burner will be installed, resulting in vendor guaranteed emission rates of 0.15 lb NO_X/MM Btu and 0.07 lb CO/MM Btu. This 200 MM Btu/hr burner will emit 30 PPH of NO_X (131.4 TPY) and 14 PPH of CO (61.32 TPY). VOC emissions are estimated per Table 1.4-1 of EPA AP-42 at 1.4 lb/MM ft^3_{gas}. At 193,237 ft^3_{gas}/hr, the emission rate of VOC is 0.27 PPH (1.18 TPY). HAP emissions are estimated to be below detectable limits. Process flow diagram 000-PF-142B reveals the layout of the dryer and ESP.

Table 3-10: AP-42 Emission Factors for AQD #82

Utility Boilers (> 100 MM Btu/hr)

Pollutant	Factor	PPH	TPY
VOC	1.4 lb/MM ft$^3_{gas}$	0.27	1.18

Note: The Btu value of natural gas is 1035 Btu/scf

AQD #83 - Silo Top

Particulate emissions resulting from the conveying of soda ash into the silos will be controlled by a dust collector. These emissions will meet a limit of 0.01 gr/dscf, resulting in a rate of 0.59 PPH of PM_{10} (2.58 TPY). No other emissions are expected. Further details can be found on the process flow diagram 000-PF-141C (see Dust Collection Point Number 43).

AQD #84 - Silo Bottom

Dust generated from the conveying of soda ash from the silos will be controlled by the Silo Bottom Bag Filter. Further details can be found on the process flow diagram 000-PF-141C (see Dust Collection Point Numbers 44 and 45). An emission limit of 0.01 gr/dscf will be met, resulting in 0.59 PPH of PM_{10} (2.58 TPY). The baghouse will be designed with a 4:1 air to cloth ratio.

AQD #85 - Industrial Boiler

A natural gas fired industrial boiler will be installed to supply heat for mine ventilation as well as other requirements throughout the facility as needed. The emission factors used for natural gas combustion for an industrial boiler rated between 10 and 100 MM Btu/hr for CO, VOC and SO_2 are noted in Table 3-11. These emission factors are derived from Table 1.4-1 of AP-42, October 1986 version.

Table 3-11: AP-42 Emission Factors for AQD #85

Industrial boilers (10-100) MM Btu/hr

Pollutant	Factor	PPH	TPY
PM_{10}	5 lb/MM ft^3_{gas}	0.48	2.10
SO_2	0.6 lb/MM ft^3_{gas}	0.06	0.26
VOC	2.8 lb/MM ft^3_{gas}	0.27	1.18

Note: The Btu value of natural gas is 1035 Btu/scf

The boiler manufacturer estimates NO_X emissions at a rate of 0.038 lb/MM Btu and CO emissions at a rate of 0.09 lb/MM Btu. Therefore, the 100 MM Btu/hr boiler will emit 3.8 PPH of NO_X (16.64 TPY) and 9.0 PPH of CO (39.42 TPY).

Identification of new and existing emission sources is presented in the facility plot plan (AQ-300, Page 1), with a key of the emission source numbers presented on page 2 of AQ-300.

3.1.2.2 Modification to Existing Sources

3.1.2.2.1 AQD #17 - Calciners #1 and #2

AQD #17, is the common stack for the two original calciners. Each calciner is equipped with a low NO_X burner and an ESP. The calciner section will be modified to increase the production rate of each calciner from a maximum of 162.5 TPH to 200 TPH, a total increase for the two of 75 TPH. This will be accomplished by replacing the existing drag conveyors downstream of the calciners with bucket elevators.

Although the burners are rated at 200 MM Btu/hr, it is anticipated that they will perform at 250 MM Btu/hr, while maintaining an emission rate of 0.05 lb NO_X/MM Btu. This will result in an increase of 2.5 PPH for each burner, or 5 PPH NO_X increase (21.9 TPY) for

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AQD #17.

The air flow will increase approximately 20 percent from a permitted rate of 100,000 dscfm to 120,424 dscfm. It is anticipated that PM_{10} emissions will not exceed the existing permit limit of 22.3 PPH. The ESPs on these units were originally designed to control particulate emissions due not only to the trona ore but also from the coal used to fire the calciners. When the units were converted to natural gas firing per MD-229, the particulate emission rate of 22.3 PPH was set from an estimate of 0.026 gr/dscfm. Based on stack testing, it is believed that these units will perform at approximately 0.022 gr/dscf; at 120,424 dscf, AQD #17 will continue to meet the existing 22.3 PPH particulate emission limit. Compliance of the particulate emission limit will be demonstrated utilizing EPA Methods 5 and 202, with the "back half inorganic" portion added to the "front half particulate" for a "total" particulate emission rate.

Although CO, VOC, and HAPs are evolved in small concentrations from the combustion of natural gas, it has been demonstrated that these compounds are also emitted from the trona ore during the calcination process. Emission factors have been derived from actual testing at the SSAJV facility. The maximum emission factor for CO is 3.81 PPT and for VOC is 1.94 PPT. At a production rate increase or 75 TPH, CO and VOC emissions are expected to increase by 286 PPH (1,252 TPY) and 145 PPH (637 TPY) respectively. Details of HAP emission increases are noted in Tables 3-2, 3-3, and 3-4.

3.1.2.2.2 AQD #48 - Calciner #3

As with AQD #17, AQD #48 is equipped with a low NO_x burner and an ESP. This calciner section too will be modified to increase the production rate from 162 TPH to 200 TPH, an increase of 38 TPH.

Although the burner is rated at 200 MM Btu/hr, it is anticipated that it will perform at 250 MM Btu/hr, while maintaining an emission rate of 0.05 lb NO_x/MM Btu. This will result in an increase of 2.5 PPH for the burner, an annual increase of 10.95 TPY of NO_x.

The air flow will increase by approximately 10 percent from a permitted rate of 54,000 dscfm to 60,212 dscfm. It is anticipated that PM_{10} emissions will not exceed the existing permit limit of 9.34 PPH. The ESP was originally designed to control particulate emissions of a coal fired unit, although it has always fired natural gas. Therefore, there is excess capacity in the ESP. It is believed that the unit will perform at approximately 0.018 gr/dscf; at 60,212 dscfm, AQD #48 will continue to meet the existing 9.34 PPH particulate emission limit. Compliance of the particulate emission limit will be demonstrated utilizing EPA Methods 5 and 202 as described above.

The same CO and VOC emission factors are used for AQD #48 as #17. With an increase in production of 38 TPH, CO and VOC emissions from AQD #48 are expected to increase by 145 PPH (634 TPY) and 74 PPH (323 TPY) respectively. Details of HAP emission increases are noted in Tables 3-2, 3-3, and 3-4.

3.1.2.3 Modification to Existing Particulate Emission Limits

Through recent testing of representative baghouses, it has been determined that a number of existing baghouses are performing at much lower particulate emissions than the permitted allowable rates. It has been determined that AQD #46 (Trona Transfer), has enough capacity to handle the emissions from AQD #2b (Ore Reclaim). Furthermore, through testing of the boiler stacks (AQD #s 18 and 19), it has been discovered that the permitted emission limit is higher than actual. To more closely reflect actual emission rates, SSAJV is requesting these identified sources have the permitted PM_{10} emission rates adjusted, as noted in Table 3-12. Other information concerning the sources is also listed.

Table 3-12: Modified Existing Particulate Emission Limits

AQD #	Source	Air:Cloth	acfm	dscfm	gr/dscf	PPH	TPY
6b	Silo reclaim	3:1	7500	5900	0.01	0.51	2.22
11	Coal transfer	4:1	3200	2500	0.01	0.21	0.94
14	Boiler coal bunker	5:1	5400	4275	0.01	0.37	1.60
18	Boiler #1	N/A	N/A	N/A	N/A	10.0	43.8
19	Boiler #2	N/A	N/A	N/A	N/A	10.0	43.8
41	Sulfite Loadout	4:1	2510	2250	0.01	0.19	0.84
46	Trona Transfer	3:1	10500	8275	0.01	0.71	3.11
47	Crusher	6:1	43094	33875	0.01	2.90	12.72
50	Dryer Area	6:1	26000	16250	0.01	1.39	6.10
53	Silo Bottom #2	6:1	13175	10500	0.01	0.90	3.94

As noted in CT-946, AQD #47 (Crusher Baghouse), was sized to handle a fourth crusher line. Since the CT-947 project was not constructed, AQD #47 still has the capacity to control particulate from a fourth crusher, which will be installed with this project.

Total annual emissions are calculated by multiplying hourly rates by 8,760 hours. Emission rates of all existing sources with proposed adjusted emission rates and the proposed expansion sources are noted in the Table 3-13.

Table 3-13: Emission Rates

AQD #	SOURCE	Name	PM₁₀ PPH	PM₁₀ TPY	NOₓ PPH	NOₓ TPY	SO₂ PPH	SO₂ TPY	CO PPH	CO TPY	VOC PPH	VOC TPY
2a	BF-1	Ore crusher	1.60	7.01								
2b ^	BF-8	Ore reclaim	0.00	0.00								
6a	BF-31	Top silos	0.30	1.31								
6b ^	BF-33	Silo reclaim	0.51	2.23								
7	BF-32	PLO	1.20	5.26								
10	BF-35	Coal crushing	0.60	2.63								
11 ^	BF-39	Coal transfer	0.21	0.92								
14 ^	BF-36	Boiler coal bunker	0.37	1.62								
15	WS-4&5	DR 1&2	6.80	29.78	1.20	5.26						
16	BF-24	Product classifier	0.90	3.94								
17	EP-1&2	CA 1&2	22.30	97.67	20.00	87.60			1238.25	5423.54	630.50	2761.59
18 ^	EP-3	BO-1	10.00	43.80	245.00	1073.10	70.00	306.60	17.50	76.65	0.50	2.19
19 ^	EP-4	BO-2	10.00	43.80	245.00	1073.10	70.00	306.60	17.50	76.65	0.50	2.19
24	BF-41	Boiler fly ash silo	0.30	1.31								
25	BF-54	AT crush and screen	1.00	4.38								
26	BF-55	AT Dryer	1.10	4.82	0.05	0.22	0.00	0.00	0.07	0.31		
27	BF-56	AT Bagging & Loadout	0.50	2.19								
28	WS-10	Fluid Bed Dryer	2.90	12.70								
30	BF-507	Lime Bin #1	0.20	0.88								
31	BF-508	Lime Bin #2	0.20	0.88								
33	WS-454	Sulfur Burner			1.50	6.57	0.40	1.75				
35	WS-455	Sulfite Dryer	1.40	6.13								
36	BF-503	Sulfite Bin #1	0.10	0.44								
37	BF-504	Sulfite Bin #2	0.10	0.44								
38	BF-505	Sulfite Bin #3	0.10	0.44								
39	BF-506	Sulfite Bin #4	0.10	0.44								
40	BF-502	Sulfite Bagging	0.00	0.00								
41 ^	BF-501	Sulfite Loadout	0.19	0.83								
43		Sulfur Storage Tank										
44	BF-509	Lime Unloading	0.90	3.94								
45	BF-53	AT Transloading	0.20	0.88								
46 ^	BF-62	Trona Transfer	0.71	3.11								
47 ^	BF-75	Exp Crusher	2.90	12.70								
48	EP-5	CA-3	9.34	40.91	10.00	43.80			617.22	2703.42	314.28	1376.55
50 ^	BF-84	Dryer Area	1.39	6.09								
51	EP-6	DR-5	4.80	21.02	18.00	78.84			2.40	10.51		
52	BF-79	Silo Top #2	0.50	2.19								
53 ^	BF-86	Silo Bottom #2	0.90	3.94								
54	BF-103	T-200 Silo	0.19	0.83								
55	BF-87	Ore recycle/reclaim	0.40	1.75								
62	BF-100	Carbon Silo	0.13	0.57								
63	BF-101	Perlite Silo	0.17	0.74								
64	BF-601	Sulfite Blending #2	0.15	0.66								
65		Sulfite Blending #1	0.06	0.26								
66	WS-9	Carbon/Perlite Scrubber	0.58	2.54								
67	BF-40	Bottom Ash	0.47	2.06								
68		Bagging Trona Silo	0.36	1.58								
70		Bagging Sulfite Silo	0.27	1.18								
71		Bagging MBS Silo	0.27	1.18								
72		MBS Soda Ash Feed	0.11	0.48								
73		MBS Dryer	1.20	5.26	0.15	0.66	0.77	3.37				
MV		Mine Vent							3.75	16.43	115.00	503.70
Modified	**Sources ***											
17		CA-1&2			5.00	21.90			285.75	1251.59	145.50	637.29
48		CA-3			2.50	10.95			144.78	634.14	73.72	322.89
New Sources												
74		North Headframe	0.34	1.49								
75		Primary Crushing	0.34	1.49								
76		Primary Screening	3.70	16.21								
77		Transfer BH 101	0.22	0.96								
78		Transfer BH 102	0.27	1.18								
79		Transfer Point	0.21	0.92								
80		Calciner #4 ESP	11.93	52.25	20.00	87.60			1047.75	4589.15	533.50	2336.73
81		Product Dryer Area BH	1.74	7.62								
82		Dryer #6 ESP	4.08	17.87	30.00	131.40			14.00	61.32	0.27	1.18
83		Silo Top	0.29	1.27								
84		Silo Bottom	0.59	2.58								
85		Boiler #3	0.48	2.10	3.80	16.64	0.06	0.26	9.00	39.42	0.28	1.23
		Total For Existing Sources	88.98	389.73	540.90	2369.14	141.17	618.32	1896.69	8307.50	1060.78	4646.22
		New Sources	24.19	105.95	53.80	235.64	0.06	0.26	1070.75	4689.89	534.05	2339.14
		Modified Sources *	0.00	0.00	7.50	32.85	0.00	0.00	430.53	1885.72	219.22	960.18
		Change	24.19	105.95	61.30	268.49	0.06	0.26	1501.28	6575.61	753.27	3299.32
		Grand Total	113.17	495.68	602.20	2637.64	141.23	618.59	3397.97	14883.11	1814.05	7945.54

NOTE:
^ Sources with modified emission limits (to more closely reflect actual emissions)
Modified Sources*: These emissions are due to the increase in throughput of the existing calciners (AQD #s 17 and 48)
NOX emissions offset by contemporaneous reduction of actual emissions totalling 596 TPY per MD-229.

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3.2 BACKGROUND SOURCES

Since total emission increases from SSAJV's proposed expansion are "significant" for PM_{10} and CO, air quality impact analyses must be performed for these two pollutants. As explained in Section 5.1.1, there is no modeling requirement for VOC (ozone). If modeled impacts exceed significant impact levels, a cumulative impact analysis, including background sources, must be performed. Regional man-made sources of pollutant emissions are considered as part of a background emissions inventory.

For CO, the necessity of including specific background sources depends upon whether maximum modeled impacts from SSAJV emission sources exceed modeling significance levels. These CO levels are 2,000 $\mu g/m^3$ and 500 $\mu g/m^3$ for one and eight-hour averaging periods, respectively. Modeling of SSAJV's CO emissions do not trigger these levels. Therefore, a cumulative impact analysis is not required and a CO background source inventory is not needed.

A potential background source for PM_{10} is determined by the contribution to PSD increment consumption, or is viewed by the WDEQ/AQD as being necessary to include in a background emissions inventory. The requirement of including a particular background source is also based on recent air quality modeling analyses submitted in support of a PSD permit application. The maximum predicted ambient PM_{10} concentrations attributable to SSAJV are below significance levels in the vicinity of each of the four regional facilities; FMC, Tg Soda Ash, General Chemical, and OCI Wyoming. In addition, several years of ambient PM_{10} sampling data have been collected upwind of the SSAJV facility that can be used as representative background PM_{10} concentrations.

Therefore, a formal PM_{10} and CO emissions inventory of the four regional soda ash facilities was not prepared.

3.3 NEW SOURCE PERFORMANCE STANDARD APPLICABILITY

New Source Performance Standards (NSPS) which apply to the proposed SSAJV expansion project include Subpart Dc - Standard for Performance for Small Industrial-Commercial-Institutional Steam Generating Units and Subpart OOO - Standards of Performance for Nonmetallic Mineral Processing Plants. Subpart Dc applies to the new boiler (AQD #85), since construction will commence after June 9, 1989 and has a maximum design heat input capacity of 100 MM Btu/hr. Subpart OOO applies to the proposed baghouses, (AQD #s 74, 75, 76, 77, 78, 79, 81, 83, and 84), since they are associated either with a crusher, grinding mill, screening operation, bucket elevator, belt conveyor, bagging operation, storage bin, enclosed truck or railcar loading station in a nonmetallic minerals processing plant.

The proposed boiler (AQD #85), is fueled with natural gas only, therefore, no emission limitations set forth in Subpart Dc apply to this unit.

WAQS&R Section 10 (b)(i) limits NO_x emissions from new natural gas fired fuel burning equipment to 0.20 lb/MM Btu of heat input. The burners on the calciner (AQD #80), dryer (AQD #82), and the boiler (AQD #85) are rated at 0.05, 0.15, and 0.038 lb NO_x/MM Btu, respectively. At these NO_x emission rates, these proposed units comply with the Section 10 limitation.

The proposed baghouses must meet the Subpart OOO particulate emission limitation of 0.05 g/dscm (0.02 gr/dscf) and 7 percent opacity limit. The new baghouse sources will be designed at 0.01 gr/dscf, half of the Subpart OOO NSPS emission limit, and will meet the 7 percent opacity limitation.

3.4 ASSESSMENT OF BEST AVAILABLE CONTROL TECHNOLOGY (BACT)

Emissions of particulate matter (PM_{10}), carbon monoxide (CO), and volatile organic compounds (VOCs) are the only criteria pollutants which exceed PSD significant emission rates. The NO_x emission increase for this project is offset by a contemporaneous decrease associated with MD-229, therefore, NO_x emissions do not trigger PSD permitting requirements. The WDEQ/AQD requires a BACT demonstration of all criteria pollutant emissions from the new and modified emission sources. This analysis will address BACT for control of PM_{10}, NO_x, CO, VOC, and other criteria pollutant emissions. The sources to be considered in the BACT analysis include all the new sources associated with the 1.2 MM TPY soda ash expansion (AQD #s 74-85). In addition, emissions of CO and VOCs from the mine ventilation exhaust shaft will be considered in the BACT analysis. (The existing mine ventilation shaft will be converted to a production shaft, upon completion of the new ventilation exhaust shaft.) The existing sources at this facility have been subjected to a BACT evaluation in previous permit applications.

EPA policy requires that BACT determinations use a "Top-Down" approach. This approach views the BACT determination on a case-by-case examination of the lowest emission rate that is technically feasible and economically reasonable for each source, and for each pollutant subject to BACT analysis. The first step in this process is to determine the most stringent commercially demonstrated emission rate. The energy, environmental, economic and technological factors are considered relative to the use of this technology/emission rate for this application. This information can be used to justify the selection of a less stringent emission rate for this specific application. The identification of a "technically viable control alternative" considers the following:

- existing control technology used by the industry

- technically feasible alternatives (technology transfer)

- innovative control technology (commercially demonstrated)

- production processes that are inherently less polluting

Documentation of viable control alternatives and demonstrated emission limits can be found in sources such as the BACT/LAER Clearinghouse and support documents submitted for PSD permit applications for similar operations to state and federal regulatory agencies. If the most stringent emission rate is selected, no further BACT analysis is necessary.

Consistent with the intent of the Top-Down approach, a description of available mitigation measures and equipment to be applied to each new or modified emission source, is provided in the following by pollutant type (i.e., PM_{10}, NO_x, CO, VOC, and other pollutants). Comparisons to previous BACT determinations for similar emission source types, is used to support the emission rate selected as BACT.

3.4.1 Particulate Matter

The new and modified point sources of particulate include:

- AQD # 74 - North Headframe
- AQD #75 - Primary Crusher
- AQD #76 - Primary Screening
- AQD # 77 - Transfer 101
- AQD # 78 - Transfer 102
- AQD #79 - Transfer Point
- AQD #80 - Calciner #4
- AQD #81 - Dryer Area
- AQD #82 - Dryer #6
- AQD # 83 - Silo Top
- AQD #84 - Silo Bottom
- AQD #85 - Industrial Boiler

For the emissions associated with the material handling systems AQD #s 74-79, 81, 83, and 84, a fabric filter baghouse or similar control device has been determined to be viable. This technology has been routinely applied to material handling systems, and is widely accepted as resulting in the lowest achievable emission rate (LAER). All particulate emissions from these new sources will be designed to achieve the emission limit for particulate of 0.01 gr/dscf. This control technology is considered to be equivalent to the most stringent control technology available. Consistent with the "Top Down" analysis, if LAER is selected, no alternative technology, and no alternative emission rates need to be evaluated. Therefore, the pollution controls chosen for the new dry product handling and conveying systems meet the BACT requirement. Furthermore, this emission rate of 0.01 gr/dscf is well below the Subpart OOO NSPS of 0.02 gr/dscf.

There are several options that have been considered for control of particulate emissions from AQD #s 80 and 82, the natural gas fired calciner and dryer. Although several options have been considered, the technology selection focused on an electrostatic precipitator (ESP) based on previous industry experience. Although other technologies have been tried in the trona industry for control of particulate from calciners and dryers, the ESP has proven to be the most cost effective. Design of an ESP and the resultant emission rate is dependent on several factors, including the material to be collected, the temperature of the exhaust stream, and the grain loading entering the ESP. The parameters associated with the calciner and the dryer for the trona industry provide a unique set of parameters to the ESP manufacturers. The specific particulate testing requirements of the State of Wyoming include the filterable particulate and the condensible inorganic material collected in the "back-half" of the sampling train (EPA Method 5/202).

Particulate emissions from AQD #85, the industrial boiler, are inherently low due to natural gas firing, and so no further control is needed.

Some particulate emissions also result from fugitive sources. Fugitive sources are generally controlled using passive measures including wetting agents or using covers to

reduce the potential for entrainment. This facility is a leader in the trona industry in emission control and the control of fugitive dust, and this expansion will be consistent with the design and operation of the existing plant. All conveyors and material handling operations will be covered or enclosed to minimize fugitive particulate emissions. Ore storage will be enclosed in a covered building. This type of control is considered BACT.

The SSAJV Tailings Pond is permitted through WDEQ-Land Quality Division, Permit #495, for 225 surface acres. As the water level in the pond fluctuates, the exposed dry beaches may lead to fugitive dust emissions if not treated. SSAJV has developed a program to control the emissions by spraying a mixture of flocculant and water on the dry areas. This forms a thin crust that has proven to be very successful in controlling fugitive emissions from the Tailings Pond area.

3.4.1.1 AQD # 74 - North Headframe

The ore handling operations at the headframe will result in some particulate emissions. These particulate emissions will be controlled by a fabric filter baghouse sized to handle 5,000 acfm, and emissions at the exit of the fabric filter will be designed to meet the emission limit of 0.01 gr/dscf . This technology and emission rate are widely recognized as BACT.

3.4.1.2 AQD #75 - Primary Crushing

The facility expansion will include the introduction of a new mining process referred to as "long wall" mining. This mining technique is expected to result in a larger run-of-mine ore. A primary crusher will be built to accept the mined ore and reduce it to minus 3" size. This source will be controlled by a fabric filter designed to handle a flow of 5,000 acfm and achieve the emission limit of 0.01 gr/dscf. This technology and emission rate are BACT.

The existing ore crusher facility was originally built and permitted per MD-132 with a large baghouse dust collection system capable of effectively treating particulate

emissions from the fourth crusher. This baghouse dust collection system controls particulate to meet the emissions limitation of 0.01 gr/dscf. Since it was originally designed to handle this additional volume of ore, this is not considered a modification to this source (AQD #47) The technology and emission rate applied to this source are BACT.

3.4.1.3 AQD #76 - Primary Screening

Particulate emissions generated from a new screening facility will be vented through a baghouse dust collection system. This fabric filter will be sized to handle a flow rate of 54,000 acfm. The emissions will be designed to meet the limit of 0.01 gr/dscf at the exit. This technology and emission rate are BACT.

3.4.1.4 AQD # 77 - Transfer 101

Particulate emissions from the conveyor transfer point transporting trona ore from the primary screen will be controlled by venting through a new baghouse sized to handle 3,250 acfm. The emissions will be controlled to meet an outlet emissions limitation of 0.01 gr/dscf. This technology and emission rate are BACT.

3.4.1.5 AQD #78 - Transfer 102

Particulate emissions generated by this transfer point on the west reclaim conveyor will be controlled by a new 4,000 acfm baghouse designed to meet the emission limitation at the outlet of 0.01 gr/dscf. This technology and emission rate are BACT.

3.4.1.6 AQD #79 - Transfer Point

Particulate emissions generated by the west reclaim transfer conveyor will be controlled by a 3,000 acfm dust collector and meet the outlet emission limitation of 0.01 gr/dscf. This technology and emission rate are BACT.

3.4.1.7 AQD #80 - Calciner #4

Particulate emissions generated from the new calciner will be controlled by an electrostatic precipitator (ESP), similar to the control technology employed on the existing calciners. The most recent BACT determination for particulate control from a calciner, indicated a BACT emission limit of 0.017 gr/dscf. For this project, ESP vendors were requested to design an ESP with an even lower emission rate if possible. Vendors have guaranteed an increase in the control efficiency to achieve 0.015 gr/dscf. This control efficiency is better than the BACT for previously permitted trona calciners. Thus, the use of an ESP on the new trona ore calciner to meet the emission limit of 0.015 gr/dscf is considered equivalent to the most stringent control available, BACT.

3.4.1.8 AQD #81 - Dryer Area

Particulate emissions from the area surrounding the new product dryer will be controlled by venting through a baghouse designed to handle 35,000 acfm throughput. The fabric filter will be designed to meet the emission limitation at the outlet of 0.01 gr/dscf. This technology and emission rate are BACT.

3.4.1.9 AQD #82 - Dryer #6

To handle the additional soda ash production, a new natural gas fired product dryer will be installed, equipped with an electrostatic precipitator (ESP), similar to the control technology employed on the existing dryer (AQD #51).   The most recent BACT determination for particulate control from a dryer, indicated a BACT emission limit of 0.017 gr/dscf. For this project, ESP vendors were requested to provide an ESP with an even lower emission rate. Vendors have guaranteed an improvement in the control efficiency to achieve 0.010 gr/dscf for this source. This control efficiency is better than the BACT for previously permitted soda ash dryers. Thus, the use of an ESP on the new product dryer to meet the emission limit of 0.010 gr/dscf is considered equivalent to the

most stringent control available.

3.4.1.10 AQD #83 - Silo Top

Particulate emissions generated from the transfer of soda ash into the product silo will be controlled by a baghouse dust collection system sized to handle 5,300 acfm. Controlled particulate emissions will be designed to meet an outlet emissions limitation of 0.01 gr/dscf. This technology and emission rate are BACT.

3.4.1.11 AQD #84 - Silo Bottom

Particulate emissions generated from the transfer of soda ash out of the silos will be controlled by a dust collector. It will be designed to handle 11,000 acfm of air, with resultant particulate emissions meeting the outlet emissions limitation of 0.01 gr/dscf. This technology and emission rate are BACT.

3.4.1.12 AQD #85 - Industrial Boiler

A 100 MM Btu/hr natural gas fired boiler will be installed to provide heat for the mine ventilation system and other areas of the facility as needed. Particulate emissions resulting from the gas combustion are predicted to be 0.48 PPH. Combustion of natural gas results in inherently low particulate emissions, and no additional controls have been applied to control particulate emissions at similar facilities. A brief review of the literature did not identify particulate control that is commercially viable for this type of installation and, therefore, no additional control is proposed.

3.4.2 Nitrogen Oxides (NO$_x$)

The new and modified sources of Nitrogen Oxide (NOx) emissions are:

- AQD #80 - Calciner #4
- AQD #82 - Dryer #6
- AQD #85 - Industrial Boiler
- AQD #17 - Calciner #s 1 & 2
- AQD #48 - Calciner #3

These sources are each fueled with natural gas. The primary means of controlling NO_x from natural gas combustion is use of an efficient burner design. In some situations where LAER is required, NO_x removal can be achieved using post combustion controls including Selective Catalytic Reduction (SCR) and Selective non-Catalytic reduction (SNCR). Post combustion control is not considered viable for this installation as explained below:

The SCR process uses ammonia in the presence of catalysts to convert nitrogen oxides into the basic elements of nitrogen and oxygen. This technology is relatively expensive, requires flue gas temperature of 500 to 800 degrees F, uses heavy metals for the catalysts, ammonia for the reagent, and often produces hazardous wastes. Ammonia is considered an extremely hazardous air pollutant, and can contribute to safety concerns at the facility. In the United States, this technology has been applied to combustion turbines, and diesel engines. Internationally there has been some application of this technology to coal-fired power plants.

The SNCR process requires a much higher flue gas temperature (1600 - 1800 degrees F) to reduce the NOx. This process has been demonstrated on combined cycle natural gas fired projects using ammonia for the reagent. Urea has also been proposed as a reagent, but operation has not been demonstrated on a similar scale.

SCR and SNCR are not considered applicable for installation in the trona industry due to many unresolved design issues. A primary concern is that the introduction of ammonia or urea will affect the quality of the product. Other concerns involve disruption of the process at the temperature zone appropriate for injection of the reagent. The process is recognized to have an emission of ammonia which "slips" through the process unreacted. There is a potential for the environmental harm caused through the manufacture and disposal of the catalyst material and the emission of ammonia during the process, to be greater than the environmental benefit gained through the additional NO_x control. Since this technology has not been applied to the trona industry in the past, there is no indication that the technology is superior to the control offered by low NO_x burners. There is no commercial demonstration of post combustion control

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technology in the trona industry, it is not considered applicable to the exhaust streams of either the calciner or the dryer.

3.4.2.1 AQD #80 - Calciner #4

North American Manufacturing Company (NAMCO) offers a Magna Flame LEX low NO$_x$ burner for applications like the calciner that utilize a refractory lined combustion chamber. Based on experience working with NAMCO, and the burners currently installed on the existing calciners, SSAJV has determined that the emission limit of 0.05 lb NO$_X$/MM Btu is achievable for this application. This is consistent with the recent BACT determination for the calciner burners approved for installation on the existing calciners and is recognized as the lowest achievable emission rate for this source.

3.4.2.2 AQD #82 - Dryer #6

There is a significant difference in the technology for burner design associated with the product dryer compared to the other sources. A significant concern in dryer design is avoiding potential contamination of the final product. The low NO$_X$ burners on the market generally use a design that incorporates a refractory around the burner. The refractory has the potential to degrade and erode over time. This is acceptable in the calciner because the product is processed and refined following the calcination process, but insoluble material is not acceptable in the product dryer. In the dryer, refractory could add contaminants to the final product, therefore a burner design with refractory is unacceptable for application in the dryer.

The design and service requirements of the product dryer in the trona industry are unique to that industry. Because of the unique requirements, review of such resources as the EPA RACT/BACT/LAER Information Clearinghouse (RBLIC) do not provide additional information regarding technology that is applicable to this emission source. NAMCO is one of the leading burner manufacturers which provides options for low NO$_X$ burner design applicable to sources in the trona industry. NAMCO commercially offers only one design option that does not have refractory and may therefore be suitable for installation in a product dryer. This NAMCO "Flame Grid" burner system is currently in

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operation on SSAJV's existing natural gas fired dryer (AQD #51). NAMCO has guaranteed a NO_X emission rate for the proposed dryer of 0.15 lb/MM Btu. NAMCO is currently bench testing a 0.05 lb NO_X/MM Btu "Magna Flame Lex Burner" with a high alloy (Inconel) liner rather than the usual refractory. This design has not been commercially demonstrated. There are substantial concerns regarding the integrity of the liner during extended operation and potential maintenance requirements. Because this design has not been commercially demonstrated, it is not considered available technology and is not evaluated further. Therefore, BACT for a soda ash product dryer is a flame grid burner with an emission rate of 0.15 lb NO_X/MM Btu.

3.4.2.3 AQD #85 - Industrial Boiler

The NSPS (40 CFR 60 Subpart Dc) for boilers of this size and type (natural gas fired, 100 MM Btu/hr) does not establish a limit for NO_X emissions. A review of the RBLIC indicated that post combustion control technology has not been installed on similar simple cycle natural gas fired boilers, and is, therefore, not considered commercially applicable technology for the boiler. Based on this information, the BACT determination has focused on burner design. The RBLIC review indicated that boilers of this type and size have used various combinations of low NO_X burner technology, including staged air combustion, flue gas recirculation, and excess oxygen controls. The lowest emission rates found for similar facilities were located in Kern County California where BACT was established at the emission limit at 0.043 lb/MM Btu for NO_X. This project has been able to obtain a lower expected NO_X emission rate, and is purchasing a package boiler designed to achieve a stack emission limit of 0.038 lb NO_X/MM Btu. This is lower than the most stringent emission limit found in reviewing other similar sources, and is therefore, by definition, considered BACT, and no further analysis is necessary.

3.4.3 Volatile Organic Compounds (VOCs) including Hazardous Air Pollutants (HAPs)

Volatile Organic Compound (VOC) emissions may result from uncombusted fuel (natural gas) or from the organics inherent in the trona ore. Included in the VOCs may be Hazardous Air Pollutants (HAPs), as listed in Section 112(r) of the Clean Air Act Amendments. HAP emissions are a relatively small component of the total VOC emission. The majority of VOC emissions from the calciner stack are assumed to be emitted during the calcination of the trona ore. This process is required to convert the ore into a crude soda ash, before further refinement. Furthermore, it has been determined that small concentrations of VOC may be emitted from the ore during the underground mining of the trona ore. Testing of the mine return air stream has revealed low concentrations of VOCs and HAPs. The mine is ventilated for the safety of the workers per Mine Safety and Health Administration (MSHA) regulations.

VOC and HAP emissions are also predicted to result from the natural gas combustion associated with the product dryer and the package boiler. The following BACT discussion for VOC controls is also relevant to the control of HAPs:

- AQD #80 - Calciner #4
- AQD #82 - Dryer #6
- AQD #85 - Industrial Boiler
- AQD #17 - Calciners #1 & 2
- AQD #48 - Calciner #3
- Mine Exhaust

3.4.3.1 AQD #80 - Calciner #4

The following sections address VOC emissions from calciner operation. The VOC emissions from calciner operations result from small concentrations of organics, inherent in the ore. This situation is unique to the trona industry.

Identification of Technically Feasible VOC Control Options

Combustion and removal are the two principal categories of control methods for VOC emissions. Applicable VOC emissions control technologies considered in identification of technically feasible control options for the calciner are listed below and are described in the following subsections.

- Destruction/Combustion (including flaring, and thermal and catalytic incineration)
- Absorption
- Adsorption
- Condensation

Tables 3-14 and 3-15 summarize cost effectiveness of these control options:

Table 3-14: Cost Effectiveness, AQD #80 VOC Control

COST COMPONENT:	Catalytic Oxidation	Carbon Adsorption	Condensation
DIRECT COSTS:			
Purchased Equipment Costs			
Basic and Auxiliary Costs (Base & 35%)	$6,376,750	$7,900,500	$9,056,250
Structural Support (10% of Basic and Auxiliary Equipment)	637,675	790,050	905,625
Sales Tax (4% of Basic and Auxiliary Equipment costs)	255,070	316,020	362,250
Freight (4% of Basic and Auxiliary Equipment costs)	255,070	316,020	362,250
Subtotal-Purchased Equipment Costs (PEC)	7,524,565	9,322,590	10,686,375
Direct Installation Costs			
Installation/Foundation (25% of PEC)	1,881,141	2,330,648	2,671,594
Subtotal-Direct Installation Costs	1,881,141	2,330,648	2,671,594
TOTAL DIRECT COSTS(TDC)	9,405,706	11,653,238	13,357,969
INDIRECT INSTALLATION COSTS			
Engineering Costs (5% of PEC)	376,228	466,130	534,319
Construction Fees and Field Expenses (15% of TDC)	1,410,856	1,747,986	2,003,695
Contingency (15% of TDC)	1,128,685	1,398,389	1,602,956
OTHER INDIRECT COSTS			
Start-up and Performance Tests (1% of TDC)	94,057	116,532	113,580
TOTAL INDIRECT COSTS	3,009,826	3,729,036	4,274,550
TOTAL CAPITAL INVESTMENT (TCI)	12,415,532	15,382,274	17,632,519
DIRECT ANNUAL COSTS			
Direct Labor (2,000 hr @ 12.50/hr)	25,000	25,000	25,000
Maintenance Labor (1,000 hr @ 15.00/hr)	15,000	15,000	15,000
Replacement Parts (1.5% of Purchased Equipment Costs)	112,868	139,839	160,296
Catalyst Replacement Cost (assumes replacement every 5 years)	995,761	N/A	N/A
Fuel Usage ($2.05 per Mscf)	5,863,000	N/A	N/A
Electricity ($0.06/kW*hr)	N/A	489,925	117,300
Steam ($0.003/lb)	N/A	65,700	N/A
Water ($1.95/1000 gal)	N/A	512,460	N/A
Waste Disposal ($2,000/ton)	N/A	N/A	1,680,000
TOTAL ANNUAL DIRECT COSTS	7,011,629	1,247,924	1,997,596
INDIRECT ANNUAL COSTS			
Overhead (60% of labor)	24,000	24,000	24,000
Property Tax (1% of TCI)	124,155	153,923	176,325
Insurance (1% of TCI)	124,155	153,823	176,325
Administration (2% of TCI)	248,311	307,645	352,650
TOTAL INDIRECT ANNUAL COSTS	520,621	639,291	729,301
TOTAL ANNUAL INVESTMENT	7,532,251	1,887,215	2,726,896

CAPITAL RECOVERY FACTOR			
Equipment Life (years) = 10			
Interest Rate (%) = 10			
Capital Recovery Factor	0.16	0.16	0.16
CAPITAL RECOVERY COSTS			
TOTAL CAPITAL REQUIREMENT	12,415,532	15,382,274	17,632,519
TOTAL ANNUAL CAPITAL REQUIREMENT	2,020,571	2,503,394	2,869,611
TOTAL ANNUALIZED COST	$9,522,821	$4,390,609	$5,596,508
(Total annual O&M cost and annualized capital cost)			
UNCONTROLLED TONS OF VOC EMITTED PER YEAR (BASELINE EMISSIONS)	923	923	923
TONS OF VOC EMITTED AFTER CONTROL	46	46	46
TONS OF VOC REMOVED PER YEAR	877	877	877
COST EFFECTIVENESS			
ENVIRONMENTAL BASIS			
($ per ton of VOC removed)	$10,858	$5,006	$6,664

Table 3-15: Cost Effectiveness of Flare

COST BASE DATE	March 1990
VAPCCI	Third Quarter 1995
INPUT PARAMETERS	
Vent flowrate (acfm)	264000
(lb/hr)	417020
Vent heat content (Btu/scf)	0
Fuel heat content (Btu/scf)	1000
Inlet gas temperature (°F)	338
Vent stream density (lb/scf)	0.0845
System pressure (psig)	10.00
Liquid density (lb/ft^3)	50
DESIGN PARAMETERS	
Gas velocity, max (ft/sec)	60.00
Auxil. fuel requirement (scfm)	113105.14
Total gas flowrate (scfm)	377105
Flare tip diameter (in)	154.59
Heat release rate (Btu/hr)	493749
Flare height (ft)	4.0
KO drum max. velocity (ft/sec)	4.84
KO drum min. diameter (in)	408.1
KO drum height (in)	1224.4
KO drum thickness (in)	0
No. of pilot burners	1
CAPITAL COSTS	
Equipment Costs ($)	
Flare/self-supported	2,231,888
Flare/guy-supported	0
Flare/derrick-supported	0
Minimum flare cost	2,231,888
Knockout drum cost	96,652
Total equipment (base)	2,328,540
Total equipment (escalated)	2,772,379
Purchased Equipment Cost ($)	3,271,408
Total Capital Investment ($)	**6,281,103**

ANNUAL COST INPUTS

Operating factor (hr/yr)	8760
Operating labor rate ($/hr)	16
Maintenance labor rate ($/hr)	17.20
Operating labor factor (hr/yr)	630
Maintenance labor factor (hr/sh)	1
Steam price ($/1000 lb)	5
Natural gas price ($/Mscf)	3
Annual interest rate (fraction)	0
Control system life (years)	15
Capital recovery factor	0.1098
Taxes, insurance admin. factor	0

ANNUAL COSTS

Item	Cost ($/yr)
Operating labor	9,853
Supervisory labor	1,478
Maintenance labor	9,419
Maintenance materials	9,419
Natural gas	500,066
Steam	6,794,757
Overhead	18,102
Taxes, insurance, administrative	251,244
<u>Capital recovery</u>	689,631
Total Annual Cost	8,283,970

CONTROL COST EFFECTIVENESS

Pollutant	VOC
Uncontrolled Emissions, lb/hr (average hourly)	210.7
Operating Hours, hr/yr	8760
Uncontrolled Emissions, ton/yr	923
Control Efficiency, %	98
Emissions After control, ton/yr	18.5
Pollutants Removed, ton/yr	904.5
Cost Effectiveness, $/ton	**9,159**

NOTE: Data used to develop this spreadsheet were taken from Chapter 7 of the OAQPS Control Cost Manual (4th edition).

VAPCCI = Vatavuk Air Pollution Control Cost Index (for flares) corresponding to year and quarter shown.

3—38

Base equipment cost, purchased equipment cost, and total capital investment have been escalated to this date via the VAPCCI and control equipment vendor data.

3.4.3.1.1 Destruction/Combustion Devices

The process most often used to control the emissions of organic compounds from process industries is incineration (also referred to as oxidation). At sufficiently high temperatures and adequate residence times, any hydrocarbon can be converted to carbon dioxide and water by the combustion process. Destruction/combustion devices are often relatively simple devices capable of achieving very high destruction efficiencies. They consist of burners, which ignite the fuel (an organic) and a chamber, which provides adequate residence time for the oxidation process. Equipment used to abate waste gases by combustion can usually be divided in three categories; flares, thermal incinerators and catalytic incinerators.

3.4.3.1.1.1 Flares

Flaring is a high-temperature oxidation process used to burn combustible components, mostly hydrocarbons, of waste gases from industrial operations. Natural gas, propane, ethylene, propylene, butadiene and butane constitute over 95 percent of the waste gases flared. During a combustion reaction, carbon dioxide (CO_2) and water are formed when gaseous hydrocarbons react with atmospheric oxygen. Several intermediate products are also formed, and eventually, most are converted to CO_2 and water, but some quantities of stable intermediate products such as carbon monoxide (CO), hydrogen, and hydrocarbons will escape as emissions. Flares are used extensively to dispose of (1) purged and wasted products from refineries, (2) unrecoverable gases emerging with oil from oil wells, (3) vented gases from blast furnaces, (4) unused gases from coke ovens, and (5) gaseous wastes from chemical industries. Gases flared from refineries, petroleum production, chemical industries and to some extent, from coke ovens, are composed largely of low molecular weight hydrocarbons with high heating value.

Flaring systems are considered technically feasible control options for the control of VOC. However, due to the large volume of the exhaust stream and extremely low Btu content, supplemental fuel and air would be required to combust the VOCs present in the exhaust stream and a steam-assisted flare would be needed to achieve the desired removal. Costs indicate that this option is not economically feasible.

3.4.3.1.1.2 Thermal Incineration

Thermal incineration is also a high-temperature oxidation process, but unlike flaring, the combustion waste gases pass over or around a burner flame into a residence chamber where combustion is completed. Thermal incinerators, also referred to as thermal oxidizers or afterburners, can be used over a fairly wide, but low, range of organic vapor concentrations. The concentration of the organics in the vapor stream must be substantially below the lower flammable level (lower explosive limit). Combustion in the thermal oxidizers is conducted at elevated temperatures to ensure high chemical reaction rates for the organics. To achieve this temperature, it may be necessary to preheat the feed stream with auxiliary energy.

Thermal recuperative and thermal regenerative are the two main types of thermal incinerators in use. The thermal recuperative type is the most common and nearly always employs a heat exchanger to preheat a gaseous stream prior to incineration. Regenerative type incinerators are newer and employ ceramics to obtain a more complete transfer of heat energy. There are no known applications of thermal recuperative incinerators on calciners, and single catalyst incinerators can achieve the same removal efficiency at potentially lower annual costs; therefore, this option is not evaluated further.

3.4.3.1.1.3 Catalytic Incineration

Catalytic incinerators are very similar to thermal incinerators, except that the combustion within the chamber takes place in the presence of a catalyst. The presence of the

catalyst in the combustion chamber reduces the combustion temperature needed to ensure complete combustion, thus reducing supplemental fuel consumption and associated operating costs. Catalysts used are typically composed of an inert substrate coated with a metal alloy that require extremely clean exhaust streams to operate efficiently. Although catalytic incinerators can achieve overall VOC control efficiencies of 95% for most applications, their capital and operating cost makes them economically infeasible for this application.

3.4.3.1.2 Absorption

Absorption is a removal control method for VOC emissions. The process of absorption refers to the contacting of a mixture of gases with a liquid so that part of the constituents of the gas will dissolve in the liquid. Referred to as scrubbing, gas absorption, as applied to the practice of air pollution, is concerned with the removal of one or more pollutants from a contaminated gas stream by treatment with liquid. The necessary condition is the solubility of these compounds in the liquid.

Absorption can be classified as physical or chemical. Physical absorption occurs when the absorbed compound simply dissolves in the solvent. Chemical absorption occurs when a reaction occurs between the absorbed compound and the liquid. The absorption rate is determined by the physical properties of the gaseous/liquid system (i.e., diffusivity, viscosity, density) and the scrubber operating conditions (i.e., temperature, flow rates of the gaseous and liquid streams). It is enhanced by lower temperatures, greater contacting surface area, higher liquid/gas ratios and higher concentrations in the gas stream. To absorb VOCs, another organic solvent must be used and this solvent must be treated to release the VOCs. Solvent emission would be greater than existing emissions.

While absorption can be considered a "technically feasible" control technology, no known applications of absorption have been applied to calciner operations at trona plants. Therefore, the application of this control method is considered "technically

3—41

unreasonable" for this application. Additionally, the cost of developing absorption applications for the process would be prohibitive. Therefore, the scrubbing option has not been further evaluated.

3.4.3.1.3 Carbon Adsorption

In adsorption technology, VOCs are selectively removed and adsorbed on the surface of an adsorbent material. The adsorbed substance does not penetrate the structure of the solid but remains entirely upon the surface. Activated carbon is the most widely used adsorbent, however other substances such as silica gel or alumina can also be used in specialized applications. Adsorbed VOCs are removed from the carbon bed by heating to a sufficiently high temperature (usually via steam) or by reducing the pressure to a sufficiently low value (vacuum desorption).

As with absorption methods, carbon adsorption systems have not been applied to the exhaust of trona calciners. Although carbon adsorption can be considered a "technically feasible" control technology, the application of this control method is considered "technically unreasonable" for this application, and even if feasible, is shown to be cost-prohibitive.

3.4.3.1.4 Condensation

Condensation is a separation technique in which one or more volatile components of a vapor mixture are separated from the remaining vapors through saturation followed by a phase change. The phase change from gas to liquid can be accomplished in two ways; the system pressure may be increased at a given temperature or the system temperature may be reduced at constant pressure. When condensers are used to control emissions, they are usually operated at the pressure of the emission source, which is typically close to atmospheric. Depending upon the temperatures required for condensation, a refrigeration unit may be necessary to supply the coolant.

Surface and contact condensers are the two most common types of condensers. With surface condensers, coolant typically flows through the tubes and the vapor condenses on the outside of the tubes. The condensed vapors form a film on the cool tubes and are drained to a collection tank for storage or disposal. In contact condensers, the vapor mixture is cooled by spraying a cool liquid directly into the gas.

Condensers generally require inlet concentrations of thousands of ppm in order to achieve removal efficiencies of greater than 80 percent. The VOC concentration of the calciner exhaust will be low, so a roto-concentrator type device would have to be used in order to concentrate the stream and make adsorption feasible. As with other technologies described above, there are no applications of condensers to calciners at trona plants. Also a cost estimate indicates that this option is cost prohibitive.

While most of the control options discussed above are considered technically feasible, none are practical and would be too costly to warrant consideration for the purpose of VOC removal from the calciner exhaust stream. Also, there are no calciners with add-on controls listed in the BACT/LAER Clearinghouse. The VOC concentrations present are quite low, given the large volume of the exhaust stream. Since there is so little energy available in the exhaust stream, energy requirements are very high for the conventional combustion-based options that would normally be applied in such a situation. A cost analysis performed for several technically feasible control options indicates that all add-on options are cost prohibitive. Therefore, the proposed BACT for the calciner is no add-on controls and efficient combustion.

3.4.3.2 AQD #82 - Dryer #6

The VOC emissions predicted for the dryer are primarily a result of the incomplete combustion of natural gas. A review of the RBLIC identified that no controls for VOC emissions have been applied to any similar process. A review of the literature has also

not identified any technology that would be appropriate to apply to this installation. Based on this review, combustion controls designed to maintain a stable flame, and VOC emission rates not to exceed 1.4 lb/MM ft$^3_{gas}$ is determined to be BACT. This source will meet this emission limit

3.4.3.3 AQD #85 - Industrial Boiler

The natural gas fired boiler is similarly considered a "clean" burning facility. The relatively small amount of VOC emissions are a result of incomplete combustion of the natural gas. No "add-on" controls have been applied to similar facilities. Based on this review, combustion controls designed to maintain a stable flame, and VOC emission rates not to exceed 2.8 lb/MM scf are determined to be BACT. This source will meet this emission limit.

3.4.3.4 AQD #17 - Calciner #s 1 & 2

See discussion of new calciner AQD #80.

3.4.3.5 AQD #48 - Calciner #3

See discussion of new calciner AQD #80.

3.4.3.6 Mine Exhaust

VOC emissions from the ore are released to the atmosphere at the mine ventilation exhaust shaft. A total of approximately 115 PPH of VOC emissions are predicted (504 TPY). This rate is based on testing of the existing mine ventilation air. Results show a VOC emission rate of 0.0113 gr/dscf. The new mine exhaust will have an air flow rate of approximately 1,500,000 acfm (1,200,000 dscfm). No feasible method has been identified to reduce the emissions from the mine vent. There are no similar sources identified in the RBLIC, and there are no control technologies considered feasible for application to a source of this size. The flow rate for this source is more than five times larger than the flow rate for the new calciner, and the concentration of VOC emissions is approximately 25 percent of the concentration resulting from the calciner. Since it has been shown to be uneconomical to provide control for the calciner, it is also

uneconomical to control a source, such as the mine ventilation exhaust air, having a lower gas temperature and a lower VOC concentration.

3.4.4 Carbon Monoxide (CO)

Carbon Monoxide (CO) will be emitted from four new or modified sources:
- AQD # 80 - Calciner
- AQD #82 - Dryer
- AQD #85 - Boiler
- AQD #17 - Calciner #s 1 & 2
- AQD #48 - Calciner #3
- Mine Exhaust

CO is a result of incomplete combustion. The installation of low NOx burners often increases the formation of CO. There are no CO controls that have been applied to any source in the trona industry. In general, CO is an undesirable product in the combustion process, and is a sign of inefficient combustion. Where NO_x control is a primary objective, higher CO emissions are generally an accepted by-product.

The primary control technique for CO has historically been the use of efficient combustion. Where additional control has been required, some type of additional oxidation process has been used to convert the CO to CO_2. Catalysts have been used to reduce CO from automobiles, combustion turbines, and from sources associated with the petrochemical industry. In some cases, boilers or flares have been used to combust relatively high concentrations of CO.

3.4.4.1 AQD #80 - Calciner #4

We have estimated the CO emission based on available source testing information. For the calciner, the estimated value includes CO that is known to form from incomplete combustion of the natural gas fuel and from the hydrocarbons inherent in the trona ore. There is some indication that a significant amount of CO is formed in the calcining process from incomplete combustion of the carbon containing compounds in the ore. Based on source testing information, the emission rate is predicted to be a maximum of

3.81 PPT, or 1,048 PPH.

A review of the RBLIC indicated that no CO controls have been applied to similar sources. There is no information indicating that there is any control technology for CO that would be feasible for installation on this type of source. The recent BACT determination prepared by OCI also indicated that there was no technology considered technically or economically feasible for this application.

3.4.4.2 AQD # 82 - Dryer #6

The dryer is estimated to produce approximately 0.07 lb of CO per MM Btu, or 14 lbs/hr at 200 MM Btu/hr. This emission rate is higher than the emission factor presented in AP-42, Table 1.4-1 of 40 lb/MM ft^3_{gas} (7.7 PPH) for natural gas fired boilers greater than 100 MM Btu/hr. The higher CO emission rate is reflective of the burner installed to minimize production of NO_X. A review of RBLIC and the literature did not indicate any CO control technology applicable to this type of process. The only feasible control technology is combustion controls to assure a stable flame and good combustion.

3.4.4.3 AQD #85 - Industrial Boiler

The CO emissions from the 100 MM Btu/hr boiler are estimated based on vendor information. The emissions will meet the limit of 9.0 PPH (0.09 lb/MM Btu). This emission rate is higher than the emission factor of 35 lb/MM ft^3_{gas}, (3.4 PPH) presented in AP-42, Table 1.4-1 and reflects the increased CO associated with the low NO_X burners selected for this installation. A review of RBLIC and the literature did not indicate any CO control technology applicable to this type of process. The only feasible control technology is combustion controls to assure a stable flame and good combustion.

3.4.4.4 AQD #17 - Calciner #s 1 & 2

See discussion of new calciner AQD #80.

3.4.4.5 AQD #48 - Calciner #3

See discussion of new calciner AQD #80.

3.4.4.6 Mine Exhaust

Some CO is released in the mine ventilation exhaust air. The concentration predicted for the mine vent shaft is an emission rate of 3.75 PPH. The CO is released during the mining process. The flow rate from the mine vent shaft (1,500,000 acfm) is very large resulting in a very low concentration of CO in this exhaust stream. No control has been applied to any source similar in volume flow rate or CO concentration. There is no technology that would be appropriate to apply to the mine vent to reduce the concentration of CO.

3.4.5 Other Pollutants

Due to the natural SO_2 scrubbing ability of trona ore and soda ash, the small amount of SO_2 emissions associated with the combustion of natural gas will be converted to sodium sulfate (Na_2SO_4) in both the new calciner and dryer (AQD #s 80 and 82). Furthermore, due to the small magnitude of SO_2 emissions anticipated from the boiler, further reductions of this pollutant would not be warranted based on environmental and economic considerations.

Ore/Product Conveyor Rates

AQD#			Associated Conveyors	Description	Expected Flowsheet Capacity	Corresponding Dust Emission Point
					tph	
74	1		410-AF-017	North Headframe Apron Feeder	402	*1
	2		410-BC-053	North Headframe Discharge Conveyor	603	*1
	3		410-BC-054	Primary Screen Feed Conveyor	1005	*2
	4		410-BC-055	Screen Feed Bin Distribution Conveyor	1005	*3
75	1		410-BC-063	Primary Screen O/S Transfer Conveyor	201	*4
	2		410-AF-019	Primary Crusher Apron Feeder	201	*5
	3		410-BC-064	Primary Crusher Discharge Conveyor	201	*6
76	1		410-AF-018 A thru D	Primary Screen Apron Feeder	250 each	*7,*8,*9,*10
	2		410-BC-057	Primary Screen O/S Collection Conveyor	201	*11,*12,*13,*14 (50 tph each) & *23
	3		410-BC-059	Primary Screen M/S Collection Conveyor	643	*15,*16,*17,*18 (161 tph each)
	4		410-BC-058	Primary Screen U/S Collection Conveyor	161	*19,*20,*21,*22 (40 tph each) & *24,*25
77	1		410-BC-061	Primary Screen U/S Transfer Conveyor	161	*26,*27
78	1		420-BC-066	West Reclaim Conveyor	643	*28,*29
79	1		420-BC-067	West Reclaim Transfer Conveyor No. 1	643	*30,*31
81	1		550-SN-019 thru 022	Product Screens	40 tph each	*33,*34,*35,*36
	2		610-BC-042	No. 4 Product Belt Conveyor	161	*38,*39,*40,*41 (40 tph each) & *41,*42
	3		610-BC-043	No. 4 Product Transfer Conveyor	161	*41
83	1		610-BC-043	No. 4 Product Transfer Conveyor	161	*43
84	1		610-BC-060	Product Loadout Belt Conveyor	161	*44,*45

Prepared by Kvaerner Davy 2/27/97

STAR STRIKE II
PRIMARY SCREENING
& STORAGE
PROCESS FLOW DIAGRAM

GREEN RIVER, WY.

SOLVAY MINERALS

Kvaerner Davy

000-PF-131

SOLVAY2016_1.4_000473

DRAWING 000-PF-132.
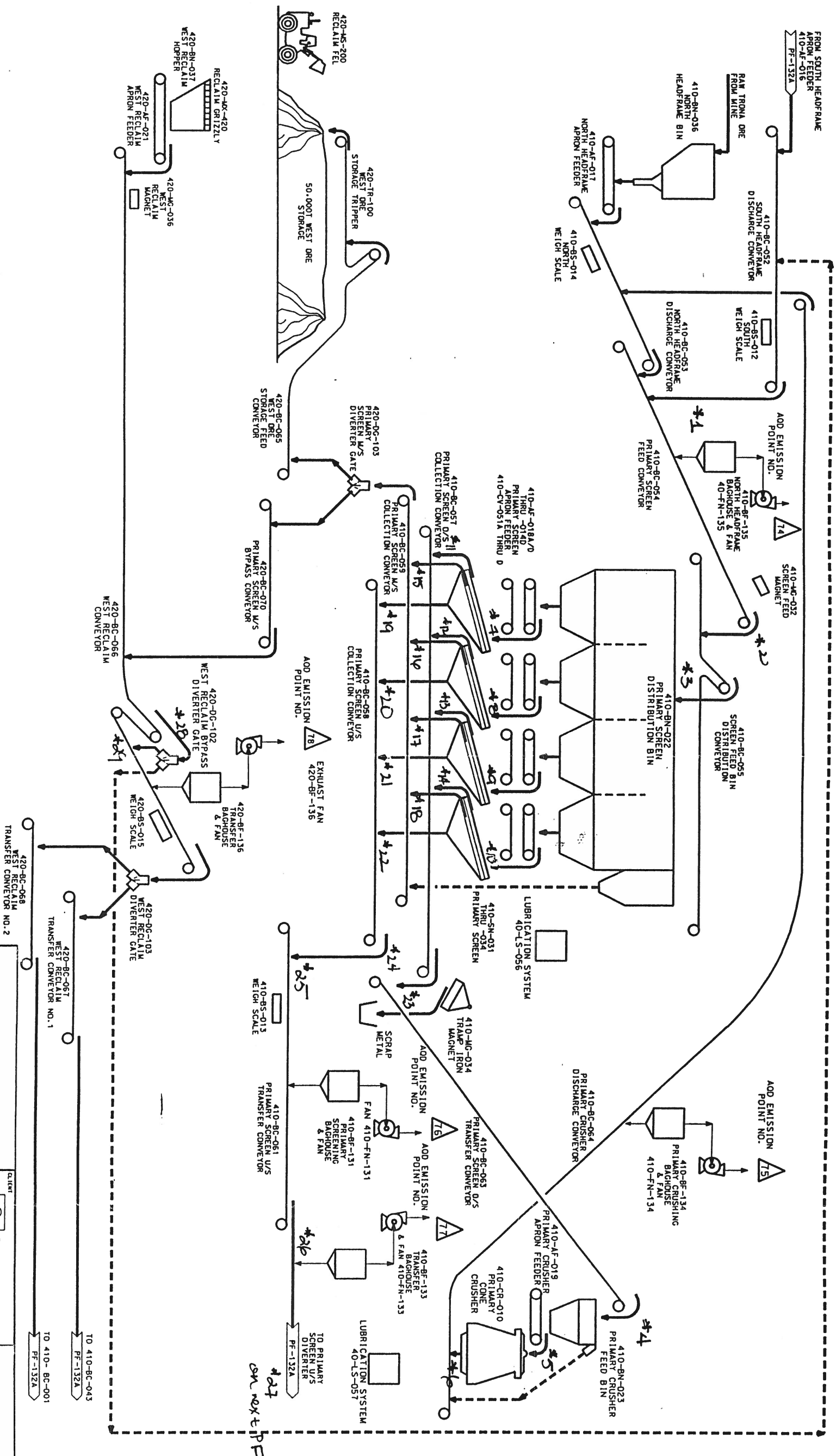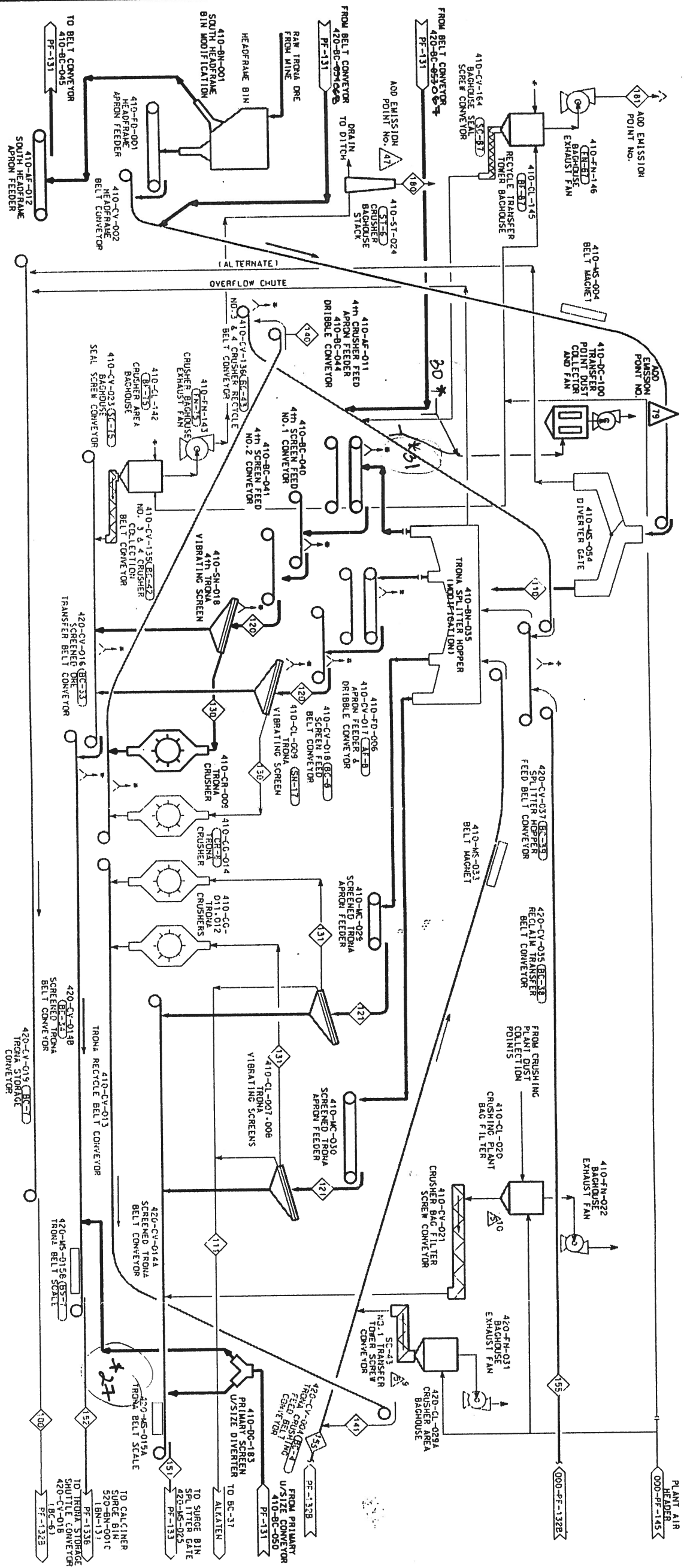
NOTE:
1. ———— DENOTES NEW EQUIPMENT OR EQUIPMENT MODIFIED FOR STAR STRIKE.
2. TOTAL FOR THIRD & FOURTH CALCINER. SEE DWG. PF-133B STREAM NO.150 FOR THIRD CALCINER COMPONENT.
3. FLOWS IN MASS BALANCE TABLE REPRESENT THE TOTAL WHEN MORE THAN ONE ARROW HAS THE SAME STREAM NUMBER.
4. ✳ FROM CRUSHING PLANT DUST COLLECTION POINTS

CLIENT

SOLVAY MINERALS
GREEN RIVER, WY.

TITLE
STAR STRIKE II
CONVEYING, CRUSHING
& STORAGE
PROCESS FLOW DIAGRAM

Kvaerner Davy
San Francisco, California

DRAWING NO. 000-PF-132A

OOPF132A.990 5-13-96 CAD-020

Equipment / stream labels (as visible):
- 410-CV-164 BAGHOUSE SEAL SCREW CONVEYOR
- 410-FN-146 BAGHOUSE EXHAUST FAN
- 410-CL-145 RECYCLE TRANSFER TOWER BAGHOUSE
- A00 EMISSION POINT NO.
- 410-DC-100 TRANSFER POINT DUST COLLECTOR AND FAN
- 410-MS-004 BELT MAGNET
- 410-MS-054 DIVERTER GATE
- 410-BN-001 SOUTH HEADFRAME BIN MODIFICATION
- 410-FF-001 HEADFRAME APRON FEEDER
- 410-CV-002 HEADFRAME BELT CONVEYOR
- 410-AF-012 SOUTH HEADFRAME APRON FEEDER
- 410-ST-024 CRUSHER BAGHOUSE STACK
- 410-AF-011 4th CRUSHER APRON FEEDER DRIBBLE CONVEYOR
- 410-BC-044 4th APRON FEEDER DRIBBLE CONVEYOR
- 410-CL-142 CRUSHER AREA A BAGHOUSE
- 410-FN-143 CRUSHER BAGHOUSE EXHAUST FAN
- 410-CV-136 CRUSHER RECYCLE SEAL SCREW CONVEYOR
- 410-CV-023 CRUSHER AREA BAGHOUSE SCREW CONVEYOR
- 410-CV-135 NO. 3 & 4 CRUSHER COLLECTION BELT CONVEYOR
- 410-BC-040 4th SCREEN FEED NO.1 CONVEYOR
- 410-BC-041 4th SCREEN FEED NO.2 CONVEYOR
- 410-SN-018 VIBRATING SCREEN
- 410-SN-035 TRONA SPLITTER HOPPER (MODIFICATION)
- 420-CV-016 SCREENED ORE TRANSFER BELT CONVEYOR
- 410-FD-006 APRON FEEDER & DRIBBLE CONVEYOR
- 410-CV-017 SCREEN FEED & DRIBBLE CONVEYOR
- 410-CL-009 VIBRATING SCREEN
- 410-CR-009 TRONA CRUSHER
- 410-CC-014 TRONA CRUSHER
- 410-CC-012 SCREENED TRONA CRUSHERS
- 410-MC-029 SCREENED TRONA APRON FEEDER
- 420-CV-037 SPLITTER HOPPER FEED BELT CONVEYOR
- 420-CV-035 RECLAIM TRANSFER BELT CONVEYOR
- 410-MS-053 BELT MAGNET
- 410-CL-007 VIBRATING SCREENS
- 410-MC-030 SCREENED TRONA APRON FEEDER
- 410-CL-020 CRUSHING PLANT BAG FILTER
- 410-FN-022 BAGHOUSE EXHAUST FAN
- 410-CV-021 CRUSHER BAG FILTER SCREW CONVEYOR
- 420-CV-014A SCREENED TRONA BELT CONVEYOR
- 420-CV-019 TRONA STORAGE CONVEYOR
- 420-CV-018B SCREENED TRONA BELT CONVEYOR
- 410-CV-013 TRONA RECYCLE BELT CONVEYOR
- 420-MS-056 TRONA BELT SCALE
- 410-DC-018 SCREEN U/SIZE DIVERTER
- 410-MS-015A TRONA BELT SCALE
- 420-FN-031 BAGHOUSE EXHAUST FAN
- 420-CL-029A BAGHOUSE
- 410-FD-031 TRANSFER TOWER SCREW CONVEYOR
- PLANT AIR 000-PF-145
- 000-PF-132B
- PF-133B
- PF-131
- PF-133

000-PF-133B

DRAWING NO.

PF-132A

FROM SCREENED TRONA
BELT CONVEYOR
420-CV-014B(BC-34)

152

150

520-DG-105
SCREENED TRONA
DIVERTER GATE

95 TON
CAP

520-BN-001(BN-3)
CALCINER SURGE BIN

520-D-004(AE-10)
TRONA APRON FEEDER

520-CV-005(BC-21)
TRONA FEEDER
CONVEYOR

520-MS-001
CALCINER
NUCLEAR WEIGH SCALE

222

520-OC-010(CH-3)
BS-3

210

890-MS-002B
CALCINER METERING
STATION

520-FN-006
(FN-26)
COMBUSTION AIR FAN

220

NATURAL GAS FROM
METERING STATION 890-MS-002A:

OUTSIDE AIR

TO TEMPERING AIR
FAN 520-FN-124A,
(SEE DWG. PF-133);
TO TEMPERING AIR FAN
520-FN-124B;
(SEE DWG. PF-133);
TO CALCINER OVERFIRE
AIR FAN 520-FN-0604;
(SEE DWG. PF-133);
TO CALCINER OVERFIRE
AIR FAN 520-FN-060B
(SEE DWG. PF-133)

HOLD COAL BURNING EQUIPMENT
LEAVE SPACE FOR:
  CALCINER FURNACE
  COAL FEED HOPPER
  COAL DISTRIBUTION
  COAL FEEDER
  CALCINER FURNACE OVERFIRE
  AIR PREHEATERS
  BOTTOM ASH BINS, & C. BLOWERS

520-FN-010
FEED CHUTE
COOLING FAN

520-FR-006C(CA-3)
ROTARY CALCINER

CLEANOUT

520-CL-056(J)
ROTARY CALCINER
DISCHARGE GRIZZLY

520-CV-017(BC-5)
LEACH FEED DRAG CONVEYOR

520-CM-130
CALCINER PIT

INFILTRATION AIR

235

520-E-C-02B THRU H
CALCINER DUST
SCREW CONVEYORS

520-OU-12?
PRECIPITATOR
DUST GATHERING
SCREW CONVEYOR

520-E-C-028(EP-6)
CALCINER
ELECTROSTATIC
PRECIPITATOR

ACD EMISSION POINT NO. ?

520-MS-13?
DUST GATHERING
CONVEYOR
AIR LOCK

TO PRE-PRIMARY LEACH TANK
520-TA-001(TA-107)
PF-133A

TO PRIMARY
LEACH TANK
520-TA-001(TA-108)
PF-133A

60

520-FN-03C(FN-?)
CALCINER I.D. FAN

DRAIN TO FLOOR

25?

255

520-ST-02?(ST-?)
CALCINER
STACK

TO CALCINER
SURGE BIN
520-BN-040
PF-133C

NOTE:
1. ———— DENOTES NEW EQUIPMENT OR
EQUIPMENT MODIFIED FOR STAR STRIKE

CLIENT

SOLVAY
MINERALS
GREEN RIVER, WY.

TITLE
STAR STRIKE II
CALCINING
PROCESS FLOW DIAGRAM

Kvaerner Davy
San Francisco, California

SCALE: NONE
PROJ. NO. 299000
DRAWING NO. 000-PF-133B
REVISION

THIS DRAWING IS NOT VALID UNLESS THE LATEST REVISION INITIALS ARE HANDWRITTEN

ISSUED FOR ESTIMATE

REVISIONS

00PF133B.990 05/13/96 CAD-020

FROM SCREENED TRONA
DIVERTER GATE
520-DG-030
PF-133B

93 TON
CAP
520-BN-014
CALCINER SURGE BIN

520-AF-012
TRONA APRON FEEDER

OUTSIDE AIR

NATURAL GAS FROM
METERING STATION 890-MS-002A

520-MS-028
CALCINER METERING
STATION

520-FN-064
CALCINER
COMBUSTION AIR FAN

520-CH-040
COMBUSTION
AIR DUCTWORK

520-BC-044
CALCINER FEED
CONVEYOR

520-BSH-010
NUCLEAR WEIGH SCALE

520-FN-100
FEED CHUTE
COOLING FAN

520-CA-004
ROTARY CALCINER

520-MS-086
ROTARY CALCINER
DISCHARGE GRIZZLY

520-EL-004
BUCKET ELEVATOR
LEACH FEED

520-PS-054
ELEVATOR PIT
SUMP PUMP

INFILTRATION AIR

520-FN-102
ESP PURGE
AIR FAN

520-SC-088 THRU 092
CALCINER DUST
SCREW CONVEYORS

520-SC-094
PRECIPITATOR
DUST GATHERING
SCREW CONVEYOR

520-EP-007
CALCINER
ELECTROSTATIC
PRECIPITATOR

520-AL-066
DUST GATHERING
CONVEYOR
AIR LOCK

520-FN-058
CALCINER I.D. FAN

520-ST-010
CALCINER
STACK

AQD EMISSION POINT NO.

DRAIN TO FLOOR

TO PRE-PRIMARY
LEACH TANK
530-TA-13T
PF-134B

TO PRE-PRIMARY
LEACH TANK
530-TA-13T
PF-134B

TO PRIMARY
LEACH TANK
530-TA-13B
PF-134B

REVISIONS
NO DESCRIPTION BY CH APPROVED DATE
REVISIONS
NO DESCRIPTION BY CH APPROVED DATE
REFERENCES

DESIGNED
DRAWN   RVH   5-1-96
CHECKED
APPROVED 1
APPROVED 2
CLIENT APP'L

CLIENT

SOLVAY
MINERALS
GREEN RIVER, WY.

TITLE
STAR STRIKE II
CALCINING
PROCESS FLOW DIAGRAM

Kvaerner Davy
San Francisco, California

SCALE NONE
PROJ. NO. 299000

DRAWING NO.
000-PF-133C

OOPF133C.950 05/13/96 CAD-020

FROM CALCINER
DUST SCREEN
520-CY-079A,B

FROM 520-CY-011A,B
LEACH FEED
DRAG CONVEYOR

PF-133

PF-153

FROM PRIMARY
THICKENER
U/F PUMP
530-PU-139C
PF-134A

530-TA-001A,B
PRIMARY LEACH
TANKS

530-MX-002A,B
PRIMARY LEACH
AGITATORS

530-TA-030
SECONDARY LEACH
PUMP BOX

530-PU-051A,B
SECONDARY LEACH
TANK O/F PUMPS

PF-175

PF-135

PF-134A

530-TA-005
SECONDARY
LEACH TANK

530-MX-006
SECONDARY
LEACH AGITATOR

530-CL-011A,B
NO.1 CLASSIFIERS
(ALTERNATE)
SEE DWG. PF-149

530-CL-033
NO.2 CLASSIFIER

PROCESS WATER
(ALTERNATE)
SEE DWG. PF-149

TO PRIMARY FILTER FEED PUMPS
530-PU-052A,B (PU-143A,B)

TO PRIMARY FILTER FEED PUMPS
530-PU-051A,B

TO PRIMARY THICKENER TANK
530-TA-014 (TA-110)

530-TA-112
NO.1 CLASSIFIER
PUMP BOX

530-PU-013A,B
NO.1 CLASSIFIER
O/F PUMPS

530-CL-015A
NO.1 THICKENER

530-TA-099
LEACH
SCRUBBER FAN

530-CL-097 LEACH
SCRUBBER

530-PU-019A,B
NO.1 THICKENER
U/F PUMPS

530-PU-021A,B
NO.1 THICKENER
O/F PUMPS

640-PU-019C
NO.1 FLOCCULANT
METERING PUMP

640-PU-084A,B
NO.1 FLOCCULANT
METERING PUMP

530-TA-083A
NO.1 FLOCCULANT
STORAGE TANK

FROM BULK
SUPPLIER

530-MX-144
CARBON SLURRY
TANK AGITATOR

530-TA-143
CARBON
SLURRY TANK

POWDERED
CARBON

530-PU-068
CARBON SLURRY
PUMP

CARBON SLURRY
PUMP PU-238

530-PU-146
CARBON
SLURRY PUMP

(ALTERNATE)

530-MX-048
REPULP TANK
AGITATOR

530-TA-047
REPULP
TANK

530-CL-029
NO.2 THICKENER

530-PU-045A,B
NO.2 THICKENER
U/F PUMPS

FROM RAW WATER PUMPS 520-PU-002A,B & C

FROM PROCESS WATER DISTRIBUTION

FROM NORTH FLOOR SUMP PUMP 530-PU-157C & D

FROM NO.3 THICKENER O/F PUMPS

FROM PRIMARY THICKENER U/F PUMP 640-PU-142 & B

NO.1 THICKENER O/F PUMP 530-PU-019C,D

THICKENER PUMP HOUSE SUMP

NO.1 THICKENER TUNNEL SUMP

NO.2 THICKENER TUNNEL SUMP

FROM CLEAR LIQUOR
TANK O/F
SEE DWG. PF-136

TO BALL MILL

530-PU-043A,B
NO.2 THICKENER
O/F PUMPS

TO PRIMARY
FILTER FEED PUMPS
530-PU-143A,B & C

TO WEAK
LIQUOR TANK

FROM WEAK LIQUOR PUMPS
540-PU-123A,B,C & D

TO CARBON/PERLITE DUST SCRUBBER

BLOW BACK FROM FILTERS

FROM FILTRATE TANK

SLUICED CAKE FROM SOUTH SUMP

PF-135

PF-143

PF-143A

PF-134

PF-123A

PF-139

PF-506

PF-146

NOTES:
1. ——— DENOTES NEW EQUIPMENT OR EQUIPMENT
MODIFIED FOR EXPANSION

REVISIONS

CLIENT

SOLVAY
MINERALS
GREEN RIVER, WY.

TITLE
STAR STRIKE II
LEACHING & THICKENING
PROCESS FLOW DIAGRAM

Kvaerner Davy
San Francisco, California

DRAWING NO.
000-PF-134

00PF134.990 05/01/96 CAD-020

SOLVAY2016_1.4_000477

DRAWING NO. 000-PF-134A

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ISSUED FOR ESTIMATE

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NOTES:
1. _____ DENOTES NEW EQUIPMENT OR EQUIPMENT MODIFIED FOR STAR STRIKE.
2. DENSITIES FOR LIQUIDS ARE CALCULATED AT THE OPERATING TEMPERATURE.

FROM DUST GATHERING CONVEYOR AIR LOCK
320-AS-330 (AL-12)

FROM LEACH FEED DRAG CONVEYOR
520-CV-017 (DC-5)

FROM 4TH CALCINER SCREW CONVEYOR

PF-133B

PF-139A

FROM WEAK LIQUOR PUMPS
540-PU-122C (PU-14C)

FROM PLANT CONDENSATE PUMPS
540-PU-134A,6 (PU-36D,E)

PF-139

530-TA-015D
SECONDARY LEACH BOX

530-PU-019C,D
SECONDARY LEACH PUMP

530-AG-010B
SECONDARY LEACH AGITATOR

530-TA-009B
SECONDARY LEACH TANK

530-CL-011C
PRIMARY RAKE CLASSIFIER

530-TA-001C (TK-107)
PRE-PRIMARY LEACH

530-TA-010D
PRIMARY LEACH TANK

530-AG-002C,D
PRIMARY LEACH AGITATORS

530-CL-013B
SECONDARY RAKE CLASSIFIER

530-TA-012A,B
PRIMARY RAKE CLASSIFIER PUMP BOXES

530-PU-013C,D
PRIMARY CLASSIFIER OVERFLOW PUMPS

(2 LINES, NO TIE ON DISCHARGE)

FROM CLAND AND DESUPERHEATING WATER PUMPS
540-PU-127C,D (PU-28C,D)

PF-139

530-TA-016
SECONDARY THICKENER TANK

530-CL-015B
SECONDARY THICKENER DRIVE

530-PU-019A,B
SECONDARY THICKENER UNDERFLOW PUMP

530-PU-021A,B
SECONDARY THICKENER OVERFLOW PUMP

530-TA-143
REPULP TANK

530-AG-143
PRIMARY THICKENER RAKE DRIVE

PF-146
PF-149   PROCESS WATER
RAW WATER

530-TA-139
PRIMARY THICKENER

530-TA-141A THRU 141D
PRIMARY THICKENER U/FLOW SCREEN BOX

530-PU-135A,B
PRIMARY THICKENER UNDERFLOW PUMP

530-PU-133C
PRIMARY THICKENER OVERFLOW PUMP

530-PU-122A,B
PRIMARY THICKENER UNDERFLOW PUMP

530-PU-173B
THICKENER SUMP PUMP

530-PU-174B
THICKENER PUMPHOUSE SUMP PUMP

530-PU-149
WEST THICKENER SUMP HOUSE SUMP PUMP

530-PU-151C,D
NORTH FLOOR SUMP PUMP

530-AG-156B
NORTH FLOOR SUMP AGITATOR

FROM FLOCCULANT METERING PUMP
540-PU-015C (PU-21C)

TO TAILINGS BALL MILL
640-GG-010

FROM PRIMARY CLASSIFIER OVERFLOW
530-PU-138A,B
PF-134B

TO WEAK LIQUOR TANK
530-TA-122
PF-139A

TO PRE-PRIMARY LEACH TANK
530-TA-137
PF-134B

TO NO.1 THICKENER FEED
530-CL-015A
PF-135

TO PRIMARY FILTER FEED
530-TA-142
PF-134

DRAWING NO: 000-PF-134B

FROM ELEVATOR
PIT SUMP PUMP
520-PS-064
PF-133C

FROM DUST GATHERING
CONVEYOR AIR LOCK
520-MS-066
PF-133C

FROM LEACH FEED
BUCKET ELEVATOR
520-EL-004
PF-133C

FROM SECONDARY THICKENER
520-FLOW PUMPS
530-PU-021A & B
PF-134A

FROM PLANT
CONDENSATE PUMPS
540-PU-136A,B
(PU-36D.E)
PF-139

(ALTERNATE)

FROM WEAK
LIQUOR PUMPS
540-PU-123C
(PU-34C)
PF-139A

530-TA-162
SECONDARY LEACH PUMP BOX

530-PU-148
SECONDARY LEACH
OVERFLOW PUMP

530-TA-161
SECONDARY
LEACH TANK
530-AG-144
LEACH TANK
AGITATOR

ALT.

530-TA-137
PRE-PRIMARY LEACH TANK
530-AG-132
AGITATOR

530-TA-138
PRIMARY LEACH TANK
530-AG-133
AGITATOR

530-CL-006,007
PRIMARY RAKE
CLASSIFIER

530-TA-145
PRIMARY RAKE
CLASSIFIER
PUMP BOX

530-PU-138A & B
PRIMARY CLASSIFIER
OVERFLOW PUMPS

(2 LINES, NO TIE ON DISCHARGE)

530-CL-008
SECONDARY RAKE
CLASSIFIER
(UPGRADE)

(GRAVITY)
(DRAIN)
(DRAIN)
(DRAIN)

530-PU-140
LEACH AREA
SUMP PUMP

FROM FLOCCULANT
METERING PUMP
640-PU-019C
(PU-31C)
PF-134

TO PRIMARY
THICKENER TANK
530-TA-139
PF-134A

TO TAILINGS
BALL MILL
640-CS-010
PF-143

TO NORTH
FLOOR SUMP
PF-134A

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CARBON DUST

FROM PLANT CONDENSATE PUMPS
540-PU-132D & E (PU-136A & B)
PF-139

FROM PRIMARY THICKENER O/FLOW PUMP
530-PU-021C & D (PU-122A & B)
PF-134A

FROM CARBON SLURRY PUMP
530-PU-062 (PU-062C)
PF-134

FROM 401.1 THICKENER
O/FLOW
PF-134

FROM CARBON SLURRY
PUMP PU-062B
PF-134

FROM ADMIX PUMP
530-PU-145
PF-135B

FROM CARBON SLURRY
PUMP
530-PU-146
PF-134

TO PRIMARY FILTERS
530-FT-035 THRU 044
PF-135B

TO CARBON SLURRY TANK
PF-134

TO PRIMARY FILTERS
530-FI-035 THRU 044

O/F TO
REPULP
TANK
DWG. PF-134

530-TA-050
PRIMARY FILTER
FEED TANK
1,000,000 GAL

530-PU-051A & B
PRIMARY FILTER
FEED PUMPS

O/F TO
FLOOR
SUMP

530-TA-142
PRIMARY FILTER
FEED TANK
1,000,000 GAL

530-PU-143A,B,C
PRIMARY FILTER
FEED PUMPS
(143A & B EXISTING)

530-PU-067C
ADMIX PUMP

BAGGED
PERLITE

HINGED
HATCH

530-MX-065
ADMIX
AGITATOR

530-PU-067A & B
ADMIX METERING
PUMPS

530-TA-064
ADMIX TANK

PROCESS
WATER
DWG. PF-149
(ALT.)

530-PU-128B
SLUICE
PUMP
265 GPM
(INTERMITTENT)

1300 GPM
OPERATING

530-PU-074A
PRECOAT PUMP

530-MX-072
PRECOAT
AGITATOR

530-TA-071A
PRECOAT TANK

BAGGED
PRECOAT

HINGED
HATCH

530-PU-074B
PRECOAT
PUMP

530-TA-071B
PRECOAT TANK

530-MX-073
PRECOAT
AGITATOR

BAGGED
PRECOAT

530-FN-163 E
CARBON/PERLITE
DUST SCRUBBER
FAN

265 GPM (INTERMITTENT)

LIQUOR DRAIN PRIOR
TO SLUICING

530-PU-128A
SLUICE
PUMP

530-FI-053A THRU J
PRIMARY FILTERS

530-FI-053K THRU J
PRIMARY FILTERS

530-GL-164
CARBON/PERLITE
DUST SCRUBBER

PRE-COAT RECIRCULATION

509 GPM OPERATING
(INTERMITTENT)

INTERMITTENT DRAIN
153 GPM (INTERMITTENT)

SLUICE

DRAIN

SLUICE

PRECOAT

FILTRATE TO FILTRATE TANK

TO FILTRATE TANK
530-TA-054
PF-135

FROM SECONDARY FILTER
SLUICE WATER TO
SECONDARY FILTERS
SOUTH FLOOR SUMP

FROM SECONDARY FILTERS
530-FI-062
TO SECONDARY FILTERS
530-FI-062
PF-136

FROM SECONDARY FILTER FEED PUMPS

700 GPM (INTERMITTENT)

PROCESS WATER
SEE DWG. PF-149

TO SECONDARY FILTER FEED PUMP (PU-14C)
PF-136

FROM SECONDARY FILTERS
530-FL-062D,E (FI-31,32)

TO SECONDARY FILTERS
530-FL-062D,E (FI-31,32)
PF-136

TO PRIMARY FILTERS
530-FI-035 THRU 044
PF-135B

NOTES:
1. ——— DENOTES NEW EQUIPMENT OR EQUIPMENT
   MODIFIED FOR EXPANSION

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TO EXISTING SCRUBBER

FROM PRIMARY FILTER
FEED PUMPS
530-PU-143A, 143B & 143C

PF-135

TO PRIMARY FILTER
FEED PUMPS
530-PU-143A,B,C

PF-135

FROM EXISTING
FILTRATE TANK
530-TA-054

PF-136

* Na₂CO₃, M.W. 105.99 CALCULATED WITHOUT ANY WATER OF HYDRATION EXCEPT AS NOTED

530-PU-145
ADMIX PUMP

530-TA-147
ADMIX TANK
530-AG-145
AGITATOR

530-TA-144
PRECOAT TANK
530-AG-135
PRECOAT TANK AGITATOR

530-PU-147
PRECOAT PUMP

BAGGED PRECOAT

530-PU-144
SECONDARY FILTER
FEED PUMP

530-FI-045 THRU 049
SECONDARY FILTERS (5)

530-FI-035 THRU 044
PRIMARY FILTERS (10)

540-TA-146
CLEAR LIQUOR
TANK
1,500,000 GAL

540-PU-150C & 150D
CLEAR LIQUOR
PUMPS

540-PU-152
CLEAR LIQUOR
PREHEATER PUMP

FROM EXISTING CLEAR
LIQUOR TANK
540-TA-001B

PF-136

FROM CLEAR
LIQUOR PREHEATER
540-HE-055

PF-139

TO CLEAR LIQUOR
PREHEATER
540-HE-055

PF-139

TO CENTRATE TANK
540-TA-158

PF-1400

FROM SLUICE PUMP
530-PU-128B
(PU-158B)

PF-135

TO EXISTING
FILTRATE TANK
530-TA-054

PF-136

DESCRIPTION

STREAM NO.	1
DESCRIPTION	PRIMARY FILTER FEED TANK
FLOW, TPH - SOLIDS	
FLOW, TPH - LIQUID	
FLOW, TPH - TOTAL	
GPM - LIQ/SLURRY	
SCFM - GAS @ 60°F	
TPH Na₂CO₃*	
PERCENT SOLIDS	
DENSITY, g/cc - SOLIDS	
- LIQUID(2)	
- SLURRY	
VISCOSITY, CP.	
TEMPERATURE, °F	
PRESSURE, PSIA	

REVISIONS

SOLVAY MINERALS
GREEN RIVER, WY.

Kvaerner Davy
San Francisco, California

TITLE
STAR STRIKE II
PRIMARY & SECONDARY
FILTRATION
PROCESS FLOW DIAGRAM

SCALE NONE

PROJ. NO. 229000

DRAWING NO.
000-PF-135B

00PF135B.990 05/13/96 CAD-020

DRAWING NO.
000-PF-136

FROM SLUICE PUMP
530-PU-126B (PU-15B)
PF-135

TO PRECOAT TANK
530-TA-017B (TA-116)
PF-135

TO PRECOAT TANK
530-TA-017B (TA-116)
PF-135

(PRECOAT RECIRCULATION)

TO PRECOAT TANK
530-TA-017B (TA-116)
PF-135

700 GPM (INTERMITTENT)

TO SECONDARY
FILTER FEED PUMP
530-PU-144
PF-135B

FROM PRIMARY FILTERS
530-FL-035 THRU 044
PF-135B

FROM PRECOAT PUMP
530-PU-074B
(PU-116)
PF-509

FROM PRIMARY FILTERS
530-FL-053K THRU D
(F1-26 THRU 30)
PF-155

FROM PRECOAT PUMP
PF-155

FROM PRIMARY FILTER
530-PU-060A,B
SECONDARY FILTER
FEED PUMPS

FROM PRIMARY FILTER
FEED PUMPS (ALTERNATE)

TO PRECOAT TANK

135 GPM INTERMITTENT

TO SOUTH FLOOR SUMP

FROM SLUICE PUMP

FROM PRIMARY FILTERS

TO PRECOAT & ADMIX FEED TANKS

TO REPULP TANK
PF-134

700 GPM INTERMITTENT

530-TA-054
FILTRATE TANK
100,000 GAL

536-PU-060C
SECONDARY FILTER
FEED PUMP

DRAIN

SLUICE

530-FL-062A,B,C
SECONDARY FILTERS

530-FL-062 D & E
(F1-31,32)
SECONDARY FILTERS

DRAIN

493 GPM INTERMITTENT SLUICE

PRECOAT

FILTRATE FROM 530-FL-062A (ALT)

SOUTH FLOOR SUMP
530-CW-156
(N/A)

530-PU-157A & B
SOUTH FLOOR
SUMP PUMPS

540-TA-001A
CLEAR LIQUOR
TANK
1,000,000 GAL

(ALT.)

540-PU-002A & B
CLEAR LIQUOR PUMPS

O/F TO
THICKENER
DWG PF-134

PU-33
CENTRIFUGE
CAKE WASH PUMP

FROM CRYSTAL CYCLONE FEED PUMPS (ALTERNATE)

TO TAILINGS (ALTERNATE)

TO CENTRATE TANK 540-TA-075A

TO FINES TANK

540-TA-001B
CLEAR LIQUOR
TANK
500,000 GAL

540-PU-002C & D
CLEAR LIQUOR PUMPS

O/F TO
FLOOR
SUMP

540-PU-095
CLEAR LIQUOR
PRE-HEATER PUMP

CLEAR LIQUOR TANK
540-TA-146

FROM CLEAR LIQUOR
PRE-HEATER
540-HE-080
PF-139

TO CLEAR LIQUOR
PRE-HEATER
540-HE-080
PF-139

TO CRYSTAL
CENTRIFUGES
540-CF-067
PF-108

TO CLEAR LIQUOR
PRE-HEATER
540-HE-080
PF-139

CLEAR LIQUOR TANK
540-TA-146
PF-135B

TO CENTRATE TANK
540-TA-158
PF-140B

PF-145

PF-135

PF-142

PF-140B

NOTES:
1. ───── DENOTES NEW EQUIPMENT OR EQUIPMENT
MODIFIED FOR EXPANSION

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i:/dgn/299000/00pf138c.990   Feb. 11, 1997   15:11:50 MSARMIEN

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REVISIONS
REVISIONS
REFERENCES

FROM PLANT
CONDENSATE PUMP
540-PU-132D,E
1PU-136A-B,C
INTERMITTENT WASH
PF-139

FROM DEFOAMER
METERING PUMP
540-PU-171
PF-140D

FROM CENTRATE PUMPS
540-PU-169A,B,C & D
PF-140D

FROM CENTRATE PUMPS
540-PU-169A,B,C & D
PF-140D

STEAM
PF-151

TO CLEAR LIQUOR
PREHEATER
540-HE-055
PF-139

FROM PLANT
CONDENSATE PUMP
540-PU-164 & C
PF-139

FROM GLAND
WATER PUMP
540-PU-167
PF-139

540-CO-015
VAPOR COMPRESSOR
(AIR COOLED)

OIL

ALT.
VENT

(RECIRC)

540-CZ-015
MECHANICAL
RECOMPRESSION
CRYSTALLIZER

540-PU-174
MVR PURGE PUMP

(OVERFLOW)

(LEVEL CONTROL)

(ELUTRIATION)

DESUPERHEATER

540-HE-060
RECOMPRESSION
HEAT EXCHANGER

540-PU-165
CRYSTALLIZER
CIRCULATION PUMP

AIR
COOLING
OIL

540-TA-153
FLASH TANK

540-PU-175 & 176
CONDENSATE
RETURN PUMPS

540-TA-154
FLASH TANK

540-PU-177 & 178
CONDENSATE
RETURN PUMPS

540-HE-061
RECOMPRESSION
HEAT EXCHANGER

540-PU-166
CRYSTALLIZER
CIRCULATION PUMP

AIR
COOLING
OIL

TO CENTRATE TANK
(540-TA-158)
PF-140D

TO FIRST EFFECT
CRYSTALLIZER (540-CO-005)
PF-137

TO 2ND EFFECT
CRYSTALLIZER
(540-CO-028)
PF-137

TO MVR CRYSTALLIZER
(540-CO-104A)
PF-138

TO OUTSIDE
PURGE TANK (TA-92)

TO CRYSTAL
COLLECTION TANK
540-TA-148
PF-138B

NOTES:

1. ALL NEW EQUIPMENT.

2. * WASH WATER (CONDENSATE). INTERMITTENT FLOW.

CLIENT
SOLVAY MINERALS
GREEN RIVER, WY.

TITLE
STAR STRIKE II
MECHANICAL RECOMPRESSION
CRYSTALLIZING
PROCESS FLOW DIAGRAM

Kvaerner Davy
San Francisco,   California

DRAWING NO.   000-PF-138C

PROJ. NO. 299000   REVISION

00PF138B.990 05/13/96 CAD-020

TO CRYSTALLIZER CIRCULATION PUMPS 540-PU-103C THRU F

TO PRIMARY THICKENER U/F PUMP 530-PU-014 C & D

FROM PRIMARY LEACH TANK 530-TA-137 PRIMARY LEACH TANK 530-TA-138

TO RECOMPRESSION HEAT EXCHANGER 540-HE-055 THRU 059

FROM CLEAR LIQUOR PRE-HEATER PUMP 540-PU-152

TO PROCESS WATER TANK 540-TA-124

FROM CLEAR LIQUOR PRE-HEATER PUMP 540-PU-124

540-HE-080 CLEAR LIQUOR PRE-HEATER

TO CLEAR LIQUOR TANK 540-TA-D01B

TO CLEAR LIQUOR STORAGE TANK 540-TA-146

O BOILER FEED STORAGE TANK 160-TA-002

FROM PROCESS WATER TANK 540-PU-126A & B

FROM CONDENSATE RETURN PUMPS 540-PU-101E THRU L

FROM CONDENSATE RETURN PUMPS 540-PU-153 THRU 160

FROM CONDENSATE RETURN PUMPS 540-PU-175 THRU 178

CONDENSATE FROM CRYSTALLIZERS

540-HE-055 CLEAR LIQUOR PREHEATER

TO SLUICE PUMPS 530-PU-188A & B

TO HOSE STATION

TO BOILER FEED WATER STORAGE TANKS

PRIME CONDENSATE SEE DWG.PF-151

CLARIFIED WATER (ALT) SEE DWG.PF-149

GLYCOL EXPANSION TANK SEE DWG.PF-155

TO PROCESS WATER DISTRIBUTION

TO CRYSTALLIZER DESUPERHEATER SEE DWG.PF-138

GLAND WATER TO CRYSTALLIZER PUMPS, WEAK LIQUOR PUMPS,DRYER C/F PUMPS, NO.2 THICKENER C/F PUMPS, SCRUBBER PUMPS, PRODUCT CYCLONE O/F PUMPS, TAILINGS RECLAIM PUMPS

TO PUMP SEAL WATER BOOSTER PUMPS SEE DWG.PF-143

540-PU-127A & B 540-PU-132A-B-C DESUPERHEATING WATER PUMPS

540-TA-126 PLANT CONDENSATE TANK 500,000 GAL

FINES TANK SEE DWG.PF-142

PRODUCT DRYER GAS SCRUBBERS & SCRUBBER TANKS (ALTERNATE) SEE DWG.PF-140

CRYSTAL CENTRIFUGES SEE DWG.PF-140B 100 GPM INTERMITTENT

CRYSTALLIZER DEMISTERS SEE DWG.PF-137,138,140C

TAILINGS BALL MILL (ALTERNATE) SEE DWG.PF-142

540-HE-240 CONDENSATE COOLER

540-PU-127C & D GLAND WATER PUMPS

540-PU-132D,E,F PLANT CONDENSATE PUMPS NEW PUMP 540-PU-156C

540-TA-125 PLANT CONDENSATE TANK 1,000,000 GAL

TO CRYSTALLIZER DESUPERHEATERS

TO LEACH TANKS

DEMISTERS & BODY WASH

PLANT AIR

35% HYDROCHLORIC ACID TANK TRUCK

540-TA-153 PLANT CONDENSATE TANK 1,000,000 GAL

540-TA-001 HCL STORAGE TANK 10,000 GAL

REF.560-MS-015

VACUUM CRYSTALLIZER TANK

DECAHYDRATE CRYSTAL CENTRIFUGE, CONDENSATE COOLER, PURGE COOLING TANK SEE DWG.PF-152

NO.1 & 2 SO2 WET SCRUBBER SYSTEM AND LIQUOR SUPPLY TANK SEE DWG.PF-152

CLARIFIED WATER SEE PF-149

560-TA-004 HCL MIXING TANK 5,000 GAL

560-PU-025 HCL CIRC. PUMP

ACID SUPPLY HEADER

FILTER AREA(4) LEACH AREA(3) DRYING AREA(2) NO.1 THICKENER AREA & NO.3 THICKENER AREA

SPENT ACID TO TAILINGS AUGER

CLIENT	
SOLVAY MINERALS	
GREEN RIVER, WY.	
TITLE	
STAR STRIKE II	
WEAK LIQUOR &	
PROCESS WATER TANKS	
PROCESS FLOW DIAGRAM	

Kvaerner Davy
San Francisco, California

DRAWING NO. 000-PF-139

SCALE NONE

DRAWING NO.

FROM SECONDARY THICKENER
OVERFLOW PUMPS
530-PU-021A & -021B
PF-134A

FROM NO. 2
THICKENER
OVERFLOW PUMPS
530-PU-043A,B
(PU-10A,B)
PF-134

TO TAILINGS
LAUNDER
PF-143

TO PRE-PRIMARY
LEACH
530-TA-137
PF-134B

TC LEACH TANKS
530-TA-001(TA-107)
530-TA-004(TA-108)
530-TA-005(TA-109)
PF-134A

TO LEACH AND
RESULP TANKS
530-TA-001,005,047
PF-134

TO TAILINGS
LAUNDER
PF-143

(ALTERNATE)

(ALT)

(ADD)

BOILER
BLOWDOWN
SEE DWG. PF-150

COOLING
WATER BLOWDOWN
SEE DWG. PF-148

CLARIFIER
UNDERFLOW
SEE DWG. PF-146

RAW WATER

FROM FLOOR
SUMPS

SHOWERS

(ALTERNATE)

540-PU-123C
(PU-34C)
WEAK LIQUOR PUMP

540-PU-123A,B,C
WEAK LIQUOR PUMPS
NEW PUMP
540-PU-034C

1,500,000 GAL.

530-TA-122
WEAK LIQUOR
TANK
DEMOLISH OLD AND
INSTALL NEW

1,500,000 GAL

540-TA-124
PROCESS WATER
TANK
DEMOLISH OLD AND
CONSTRUCT NEW

(ALTERNATE)

540-PU-136A-S
(PU34L.S)
PROCESS WATER
PUMPS
NEW PROCESS
WATER PUMP
540-PU-035C

(ALTERNATE)

TO PLANT
CONDENSATE TANK
540-TA-136 (TA-136)
PF-139

TO PROCESS WATER
DISTRIBUTION
SEE DWG PF-137

OFF SPEC
CONDENSATE
PF-149

PLANT
CONDENSATE
PF-151

CLARIFIED WATER
PF-49

FROM CONDENSATE
RETURN PUMP
PF-149

CLARIFIED WATER
PF-49

FROM CONDENSATE
RETURN PUMP
DISTRIBUTION
PF-151

511 GPM

(2ND ALTERNATE)

NOTES:

1. ———— DENOTES NEW EQUIPMENT OR
         EQUIPMENT MODIFIED FOR THE EXPANSION.

CLIENT

SOLVAY
MINERALS

GREEN RIVER, WY.

TITLE
STAR STRIKE II
WEAK LIQUOR AND
PROCESS WATER TANKS
PROCESS FLOW DIAGRAM

Kvaerner Davy
San Francisco, California

SCALE   NONE
DRAWING NO.   000-PF-139A

PROJ. NO.   296000

OOPF139A.990 05/01/96 CAD-950

Feb. 11, 1997 15:13:21 MSARMIEN

NOTE:

1. ——— DENOTES NEW EQUIPMENT OR EQUIPMENT MODIFIED FOR STAR STRIKE.

CLIENT

SOLVAY MINERALS
GREEN RIVER, WY.

TITLE
STAR STRIKE II
CENTRIFUGE &
PURGE RECOVERY
PROCESS FLOW DIAGRAM

Kvaerner Davy
San Francisco,   California

| SCALE | NONE | DWG. NO. | 000-PF-140B |
| DRAWING NO. | | PROJ. NO. | 299000 | REVISION | |

000-PF-140B

OOPF140B.990

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REVISIONS

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SOLVAY2016_1.4_000487

000-PF-140D
DRAWING NO.

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REVISIONS

NOTE:
1. ALL NEW EQUIPMENT.

FROM CRYS CYCLONE FEED PUMPS
540-PU-151A & B
PF-138B

540-CY-023 THRU 029
CRYSTAL CYCLONES

TO PRODUCT DRYER
550-DR-006
PF-141D

FROM DUST COLLECTION
AIR LOCK
550-AL-010
PF-142B

PROCESS WATER
PF-149

FROM EXIST LEVEL
CONTROL PUMPS
PF-140B

OVERFLOW FROM
MVR CRYSTALLIZER
540-CZ-021
PF-138B

OVERFLOW FROM
MVR CRYSTALLIZER
540-CZ-022
PF-138B

OVERFLOW FROM
MVR CRYSTALLIZER
540-CZ-023
PF-138B

FROM CLEAR
LIQUOR PUMPS
540-PU-150C.D
PF-138B

FROM CLEAR
LIQUOR PUMPS
540-PU-150C & D
PF-136

TO MVR CRYSTALLIZER
540-CZ-021
PF-138B

TO MVR CRYSTALLIZER
540-CZ-022
PF-138B

TO MVR CRYSTALLIZER
540-CZ-023
PF-138C

TO EXISTING CENTRATE TANK
540-TA-075B
PF-140B

540-PU-159A,B,C & D
CENTRATE PUMPS

410 (LEVEL CONTROL)

(ELUTRIATION)

565

540-TA-158
CENTRATE TANK
540-AG-136
AGITATOR

540-PU-171
DEFOAMER
METERING
PUMP

540-TA-160
DEFOAMER
DAY TANK

540-PU-170
DEFOAMER
TRANSFER PUMP

FROM ANTIFOAM
STORAGE TANK
530-TA-078

(BY GRAVITY)

540-HE-051
CENTRIFUGE COOLER

AIR

540-HE-052
THRU 058
CENTRIFUGE
OIL/GLYCOL
COOLER

GLYCOL

PLANT CONDENSATE
(ALTERNATE)

540-CE-012 THRU 018
CENTRIFUGES

540-SC-095
DRYER FEED
SCREW CONVEYOR

SLIDE GATE

FLOOR TRENCH

PF-139

PF-140B

TO MVR CRYSTALLIZER
540-CZ-021
PF-138B

TO MVR CRYSTALLIZER
540-CZ-022
PF-138B

TO MVR CRYSTALLIZER
540-CZ-023
PF-138C

TO ANTIFOAM
STORAGE TANK
530-TA-078

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ISSUED FOR ESTIMATE

REVISIONS
NO | DESCRIPTION | BY | CK | APPROVED | DATE

REVISIONS
NO | DESCRIPTION | BY | CH | APPR'D | DATE

REFERENCES

DESIGNED
DRAWN
CHECKED
APPROVED 1
APPROVED 2
CLIENT APP 1

ACID EMISSION POINT NO.

TO DUST TRANSFER
SCREW CONVEYOR
550-CV-109(SC-18,A,B)

TO DRYER ELECTROSTATIC
PRECIPITATOR
540-CV-101(SC-20)

FROM CRYSTAL
SCREW CONVEYOR
540-CV-101(SC-20)

PF-140B

PF-142A

550-FN-003
FRCM METERING
STATION

PF-142A

DRYER METERING
STATION
890-WS-002C

DRYER COMBUSTION
AIR FAN
550-FN-007

550-ST-105
PRODUCT
BACKHOUSE
STACK

550-FN-004
PRODUCT
BACKHOUSE FAN

550-CV-056B
PRODUCT BACKHOUSE
SCREW CONVEYOR

550-ME-057
PRODUCT BACKHOUSE
AIRLOCK

550-CL-003
PRODUCT
DRYER BACKHOUSE

PF-142A

FROM PRODUCT
ESP AIR LOCK
550-ME-100(AL-15)

540-CV-071(SC-20)
CRYSTAL
SCREW CONVEYOR

550-HT-001C
PRODUCT
DRYER

550-FN-006
FEED CHUTE
COOLING FAN

INFILTRATION
AIR

PLANT AIR

550-ME-016C
PRODUCT DRYER
DISCHARGE GRIZZLY

ALTERNATE
TO FLOOR

550-CG-031C
PRODUCT
CAGE MILL

550-EV-021C
PRODUCT
BUCKET ELEVATOR

550-EL-019?
VAN LIFT

CHUTE MAGNET

SCREW CONVEYOR

550-CV-107C
?ES

550-PU-119
FS1?
ELEVATOR PIT
SUMP PUMP

550-CV-107C
?ES
SCREW
CONVEYOR

610-CV-042A
PRODUCT
BELT CONVEYOR

No. 3 PRODUCT
COLLECTION CONV.
610-BC-058

610-WS-011
BELT SCALE

610-WS-011
?DIVERTER
ALTERNATE

610-WS-006(H)
CHUTE MAGNET

MANUAL SAMPLERS   4"

610-WS-006(H)
AIR CLASSIFIER

550-CL-002(H)
PRODUCT SCREENS

No. 3 PRODUCT
TRANSFER CONV.
610-BC-042

TO NO. 4
PRODUCT CONVEYOR
610-BC-042

NOTE:
1. ———— DENOTES NEW EQUIPMENT OR
         EQUIPMENT MODIFIED FOR STAR STRIKE.

CLIENT

SOLVAY MINERALS
GREEN RIVER, WY.

Kvaerner Davy
San Francisco, California

TITLE
STAR STRIKE II
PRODUCT DRYING
SIZING & LOADOUT
PROCESS FLOW DIAGRAM

DRAWING NO.
000-PF-141B

PROJ. NO. 299000
REVISION

SOLVAY2016_1.4_000489

j:/dgn/299000/00pf141c.990   Feb. 11, 1997   15:18:51 MSARMIEN

NOTES:

1. ———— DENOTES NEW EQUIPMENT OR EQUIPMENT MODIFIED FOR THE EXPANSION.

2. BASED ON 90% AVAILABILITY 1.25 MM TPY PRODUCT FROM STEAM TUBE DRYERS.

3. BASED ON MAXIMUM LOADOUT RATE EXPERIENCED AT PLANT DURING 8 HOUR SHIFT.

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FROM NO. 4 PRODUCT TRANSFER
BELT CONVEYOR
550-3C-043

FROM DIVERTER   610-0G-010
PF-141D

FROM DIVERTER   610-0G-010
610-CV-001A
PF-141B

FROM DIVERTER   610-0G-015
610-CV-002A
PF-141D

FROM DIVERTER   610-0G-015
610-CV-002A
PF-141B

FROM DIVERTER   610-0G-030
610-0G-030
PF-141D

FROM   610-CV-001A
PF-141

FROM   610-MS-010 DG-15
610-MS-010 DG-15
PF-141B

610-MS-012A THRU F
ROLLING BLADE GATE VALVES

610-BN-008,009
PRODUCT SILOS

610-CV-003
PRODUCT TRANSFER BELT CONVEYOR

610-CV-004
PRODUCT TRANSFER BELT CONVEYOR

610-MS-024 MAGNET

610-MS-007 DIVERTER

610-MS-006 DIVERTER

610-CV-013
PRODUCT LOADOUT BELT CONVEYOR

610-CV-014
PRODUCT LOADOUT BELT CONVEYOR

610-MS-012G THRU F
ROLLING BLADE GATE VALVES

610-BN-010,011
PRODUCT SILOS

610-CV-015
PRODUCT LOADOUT BELT CONVEYOR

610-CV-018
PRODUCT LOADOUT BELT CONVEYOR

610-CV-018A
BAG FILTER SCREW CONVEYOR

610-BF-019A
PRODUCT SILO BAG FILTER-TOP

UPPER SILO AREA DUST
PLANT AIR

610-CL-017A
PLANT AIR SILO

610-FN-019A
BAG FILTER EXHAUST FAN

610-0G-031 DIVERTER

610-MS-055 DIVERTER

610-MS-050
PRODUCT BELT CONVEYOR

610-MS-014A THRU F
ROLLING BLADE GATE VALVES

610-BN-012,013
PRODUCT SILOS

610-CV-051
PRODUCT LOADOUT BELT CONVEYOR

610-MS-060 DIVERTER

610-CV-052
PRODUCT LOADOUT BELT CONVEYOR

610-BN-019
PRODUCT SILO TOP BIN VENT

610-BF-081
PRODUCT SILO TOP BIN VENT

610-TA-156,157
PRODUCT SILOS

610-SC-038 THRU 047
ROLLING BLADE GATE VALVES

610-BF-081B
PRODUCT SILO TOP BIN VENT

UPPER SILO AREA DUST
PLANT AIR

ADD EMISSION PT. NO.

610-FN-107
PRODUCT SILO BIN VENT FAN

610-FN-019B
PRODUCT SILO BIN VENT FAN

610-AL-011
BOTTOM BAG FILTER AIRLOCK

610-BF-090
PRODUCT SILO BOTTOM BAG FILTER

610-FN-108
PRODUCT SILO BOTTOM BAG FILTER FAN

ADD EMISSION POINT NO.

SC-53
BOTTOM SILOS BAGHOUSE SCREW CONVEYOR

610-CL-014A
PRODUCT SILO BAG FILTER BOTTOM

610-FN-045A
BAG FILTER EXHAUST FAN

LOWER SILO AREA DUST
PLANT AIR

610-CL-014B
BOTTOM SILO BAG FILTER BOTTOM

SC-54
BOTTOM SILO SEAL SCREW CONVEYOR

BELT FLOW
ALTERNATE TO GRADE

610-CV-016
PRODUCT LOADOUT BELT CONVEYOR

TOTE BOX

610-CL-022
FINAL PRODUCT SCREEN

610-MS-022
TRUCK LOADING SPOUT

610-MS-036
TRUCK SCALE

610-MS-034
TRACK SCALE

370 TON

610-CL-026
PRODUCT LOADOUT BAG FILTER

610-BN-023
LOADOUT BIN

610-MS-030A THRU F
PRODUCT LOADOUT SCREW CONVEYOR

610-MS-031A THRU F
RAIL CAR LOADING SPOUTS

SC-57
PRODUCT LOADOUT BOTTOM BAG FILTER

610-FN-028
BAG FILTER EXHAUST FAN

LOADOUT AREA DUST
PLANT AIR

610-MS-057
SHROUD ADAPTER (SLOTTED CARS ONLY)

610-FN-058
PRODUCT SILO BOTTOM BAG FILTER FAN

610-MS-033
CAR MOVER

CLIENT

SOLVAY MINERALS
GREEN RIVER, WY.

Kvaerner Davy
San Francisco, California

TITLE
STAR STRIKE II
PRODUCT DRYING
SIZING & LOADOUT
PROCESS FLOW DIAGRAM

SCALE: NONE

DRAWING NO.   000-PF-141C

PROJ. NO. 299000

00PF141C.990 05/13/96 CAD-020

AOD EMISSION POINT NO.

550-ST-012 PRODUCT BAGHOUSE STACK

TO DUST TRANSFER SCREW CONVEYOR 550-SC-101

550-FN-106 PRODUCT BAGHOUSE FAN

550-SC-102 PRODUCT BAGHOUSE SCREW CONVEYOR

550-BF-008 PRODUCT DRYER BAGHOUSE

550-AL-068 PRODUCT BAGHOUSE AIRLOCK

DRYING AREA DUST COLLECTION POINTS

FROM PRODUCT ESP AIR LOCK 550-AS-067

PF-142B

TO DUST TRANSFER SCREW CONVEYOR 550-SC-101

PF-142B

TO DRYER ELECTROSTATIC PRECIPITATOR 550-EP-007

FROM CRYSTALLIZER SCREW CONVEYOR 540-SC-095

PF-140D

550-FN-071 DRYER COMBUSTION AIR FAN

FROM METERING STATION

NATURAL GAS

550-WS-003 DRYER METERING STATION

550-DR-006 PRODUCT DRYER

550-FN-092 FEED CHUTE COOLING FAN

INFILTRATION AIR

PLANT AIR

550-WS-077 PRODUCT DRYER DISCHARGE GRIZZLY

ALTERNATE TO FLOOR

550-CR-012 PRODUCT CAGE MILL

550-EL-005 PRODUCT BUCKET ELEVATOR

550-EL-006 FREIGHT ELEVATOR

550-WS-030 CHUTE MAGNET

610-DC-030 DIVERTER GATE

610-BC-042 NO. 4 PRODUCT BELT CONVEYOR (REVERSIBLE)

610-BS-001 NO. 4 PRODUCT WEIGH SCALE

610-BC-043 NO. 4 PRODUCT TRANSFER CONVEYOR

550-SN-019 THRU 022 PRODUCT SCREENS

550-PS-064 PRODUCT ELEVATOR PIT SUMP PUMP

FROM NO. 3 PRODUCT TRANSFER CONVEYOR 610-BC-059

PF-141B

TO DIVERTER 610-DC-051

PF-141C

TO EXIST. BELT CONVEYOR 610-BC-013

PF-141C

TO EXIST. BELT CONVEYOR 610-BC-014

PF-141C

TO NORTH FLOOR SUMP

PF-134A

NOTE:

1. ALL NEW EQUIPMENT.

REVISIONS

ISSUED FOR ESTIMATE

REFERENCES

SOLVAY MINERALS
CLIENT

STAR STRIKE II PRODUCT DRYING SIZING & LOADOUT PROCESS FLOW DIAGRAM

GREEN RIVER, WY.

Kvaerner Davy
San Francisco, California

DRAWING NO.
000-PF-141D

PROJ. NO. 299000

00F141D.990   05/13/09 CAD-020

FROM
PRODUCT DRYER
550-DR-006
PF-1410

TO PRODUCT
BUCKET ELEVATOR
550-EL-005
PF-1410

FROM PRODUCT
BAGHOUSE AIR LOCK
550-AL-068
PF-1410

550-SC-096 THRU 100
DRYER ESP
SCREW CONVEYOR

550-AL-067
ESP AIR LOCK
PRODUCT DRYER

(ALT)

550-EP-007
DRYER ELECTROSTATIC
PRECIPITATOR

550-SC-101
DUST COLLECTING
SCREW CONVEYOR

550-AL-070
DUST COLLECTION
AIR LOCK

550-LS-059
DRYER
FAN LUBE
SYSTEM

550-FN-105
PRODUCT DRYER
ID FAN

550-ST-011
DRYER ESP
STACK

DRAIN TO FLOOR

AOD EMISSION
POINT NO.

TO CENTRATE
TANK
540-TA-15B
PF-1400

NOTE:
1. ALL NEW EQUIPMENT.
2. MAXIMUM FOR AOD EMISSION POINT.

SOLVAY2016_1.4_000492

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FROM SOFT WATER PUMPS

FROM SOFT WATER PUMPS

FROM MONOHYDRATE DRYER
300 PSIG
CONDENSATE

FROM CHEMICAL STORAGE AREA
FILL
MANUAL

BOILER CHEMICAL FEED PACKAGE
PP-01
PP-02

PV-001

SOFT WATER

NNF

ATMOSPHERIC AIR

P-001

P-002

P-003

HE-001

BL-001
BOILER PACKAGE

EX-001

FLUE GAS

NOX CONTROL

VENT

ADD EMISSION POINT NO. 55

EX-002

SUMP PUMP
SU-001

BLOWDOWN

PV-002
VENT

TO PURGE COLLECTION TANK

300 PSIG STEAM
TO MONOHYDRATE DRYER

30 PSIG STEAM
TO PLANT UTILITY DIST. SYSTEM

TO TRONA BELT FILTERS

GAS SUPPLY

REVISIONS

SOLVAY MINERALS
GREEN RIVER, WY.

UTILITIES
STEAM AREA

Kvaerner Davy
San Francisco, California

DRAWING NO.
000-PF-143

SOLVAY2016_1.4_000493

4. EXISTING ENVIRONMENT

4.1 TOPOGRAPHY

The Solvay Soda Ash Joint Venture facility is located in southwestern Wyoming in Sweetwater County approximately 60 kilometers (37 miles) west of Rock Springs. The project area is in the Green River drainage basin bounded by the Wyoming Ranges to the west and northwest and the Wind River Range to the northeast. The Flaming Gorge National Recreation Area is located to the southeast. Elevations in the project area generally range from 6200 ft to 6600 ft.

4.2 AIR QUALITY

Ambient air quality monitoring has been conducted in the project area. Previously monitored parameters included SO_2, NO_x, and total suspended particulate (TSP). Currently, PM_{10} and $PM_{2.5}$ (particulate matter less than 10 and 2.5 μm, respectively) are monitored both upwind and downwind of the facility, with a single TSP monitor located downwind. Maximum measured pollutant concentrations are presented in Table 4-1 and can be compared to Wyoming Ambient Air Quality Standards (WAAQS) and the National Ambient Air Quality Standards (NAAQS) presented in Table 4-2. The NO_x concentration for the first quarter of 1987 was 0.01 ppm (18.8 μg/m^3). However, the quarterly averages for the remainder of the monitoring year were rounded to 0.00 ppm. This resulted in an annual average NO_x concentration of 0.0025 ppm (4.7 μg/m^3). SO_2 and NO_x concentrations in the project area are considerably below applicable WAAQS and NAAQS. Ambient monitoring of SO_2 and NO_x was discontinued in 1988, due to the low concentrations monitored. There has never been an exceedance of PM_{10} since monitoring began in 1989.

Table 4-1: Maximum Measured Pollutant Concentrations

Pollutant		Averaging Time	Concentration ($\mu g/m^3$)	Year
PM$_{10}$	Upwind	24 hr.	27	1996
		2nd highest 24 hr	26	
		Annual	10.22	
	Downwind	24 hr.	34	1996
		2nd highest 24 hr	27	
		Annual	13.88	
SO$_2$		3 hr.	78.2	1987
		24 hr.	26.1	
		Annual	0	
NO$_2$		Annual	4.7	1987

4—2

Table 4-2: National and Wyoming Ambient Air Quality Standards

		SUMMARY OF NATIONAL AND WYOMING AMBIENT AIR QUALITY STANDARDS		
		NAAQS		
POLLUTANT	AVERAGING TIME	PRIMARY $\mu g/m^3$ (ppm)	SECONDARY $\mu g/m^3$ (ppm)	WAAQS $\mu g/m^3$ (ppm)
Carbon Monoxide[a]	1-hour[b]	40 (35)	40 (35)	40 (35)
	8-hour[b]	10 (9)	10 (9)	10 (9)
Nitrogen Dioxide	Annual	100 (0.05)	100 (0.05)	100 (0.05)
Ozone	1-hour[c]	235 (0.12)	235 (0.12)	160 (0.08)
Particulates (PM10)	24-hour[b]	150 (--)	--	150 (--)
	Annual (arith. mean)	50 (--)	--	50 (--)
Sulfur Dioxide	3-hour[b]	--	1300 (0.05)	1300 (0.05)
	24-hour[b]	365 (0.14)	--	260 (0.10)
	Annual	80 (0.03)	--	60 (0.02)
Hydrogen Sulfide	1/2-hour	--	--	70 (0.05)[d]
		--	--	40 (0.03)[e]
Lead	Calendar Quarter	1.5 (--)	1.5 (--)	1.5 (--)

[a] In mg/m^3 (and ppm).
[b] Not to be exceeded more than once per year.
[c] Not to be exceeded more than 1 day per year, based on a 3-year running average.
[d] Not to be exceeded more than 2 times per year.
[e] Not to be exceeded more than 2 times in any five consecutive days.

An IMPROVE (Interagency Monitoring of Protected Visual Environments) visibility monitoring system was installed in the Green River basin during the summer of 1996. The site includes a transmissometer, nephelometer, aerosol monitors, and meteorological monitors. This visibility data is still preliminary, but will be available in the future.

4.3 CLIMATE AND SITE METEOROLOGY

Wyoming can be characterized as having a combination of a highland climate and a mid-latitude semiarid climate. The dominant factors which affect the climate of the area are elevation, local relief, and the mountain barrier effect. This barrier effect can produce marked temperature differences between windward and leeward slopes. Generally temperatures decrease and precipitation increases with increasing elevations.

The nearest available precipitation and temperature data are collected at Green River and Rock Springs, Wyoming, respectively, to the east of the project location. Precipitation amounts are generally consistent throughout the year with May being the wettest month and February the driest month.

The average annual precipitation at Green River is 7.74 inches. However, mid-latitude semiarid climates are characterized by great variability of precipitation from year to year. A summary of precipitation amounts is presented in Table 4-3. Temperatures in mid-latitude semiarid regions are marked by large diurnal and seasonal ranges. At Green River, temperatures range from an average minimum near 0°F in January to an average maximum of near 90°F in July. Temperature extremes as high as 104°F and as low as –42°F have been recorded. A summary of monthly and annual average temperatures is presented in Table 4-4.

Table 4-3: Average Precipitation - Green River, Wyoming

MONTH	PRECIPITATION (inches)
January	0.39
February	0.31
March	0.50
April	0.81
May	1.21
June	0.98
July	0.63
August	0.76
September	0.68
October	0.73
November	0.40
December	0.34
Annual Total	**7.74 INCHES**
Source: NOAA	

Table 4-4: Average Temperature for the Rock Springs, Wyoming Airport

Month	Maximum (°F)	Minimum (°F)	Mean (°F)
January	32.1	4.7	18.4
February	37.5	8.9	23.2
March	44.5	16.8	30.7
April	55.7	26.9	41.3
May	67.9	36.0	52.0
June	77.9	43.4	60.7
July	87.0	49.4	68.2
August	84.1	47.2	65.7
September	74.8	36.8	55.9
October	63.0	26.8	44.9
November	45	15.8	30.4
December	35.4	7.3	21.4
Annual Mean	**58.7**	**26.7**	**42.7**
Source: NOAA			

Wind data are collected at Rock Springs, Wyoming, to the east of the project site. Although wind patterns are significantly influenced by local topography, the predominant wind directions at Rock Springs are from the west through southwest. Maximum wind speeds are associated with west winds.

4.4 SOILS AND VEGETATION

Soils in southwest Wyoming vary in physical and chemical characteristics as determined primarily by geologic, topographic, vegetative, and climate factors. The area is characterized by uplifted fault blocks which form the major ridge and relatively flat-lying

clay shales and siltstone forming the intervening valleys. The ridges are mainly composed of limestones, dolomites, and quartzes of Paleozoic and older Mesozoic age. Side ridges and valleys are formed by the Wasatch Formation of the Eocene age. Soils occurring at the ridge crests are typically shallow over bedrock and have textures ranging from very gravelly to very cobblely, sandy loams or loams. These soils have textural, depth and drainage characteristics that limit the amount of water these soils can hold and make available for plant growth.

Soils in the valleys are deeper and consist mainly of very gravelly or very cobblely colluvium and alluvium, primarily overlying dry shales.

Vegetation in the area is dominated by sagebrush and desert grasses such as thickspike, wheatgrass, squirreltail, and needlegrass. No listed threatened or endangered plant species are known to occur in the project area.

5. IMPACT ASSESSMENT APPROACH

5.1 AIR QUALITY MODELING

An air quality modeling analysis has been performed to assess impacts associated with the expansion of the SSAJV facility. The pollutants evaluated include criteria pollutants PM_{10}, CO, NO_x, SO_2, and a number of hazardous air pollutants (HAPs). Emissions were modeled to determine compliance with the National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) Increments, and to assess impacts with respect to HAPs criteria. In addition, emissions were modeled to determine effects on air quality related values (AQRVs) at surrounding Class I Areas and parks.

All of the analyses are based on the Environmental Protection Agency (EPA) Industrial Source Complex Model - Version 3 (ISC3). ISC3 is selected for its ability to model multiple sources in simple and complex terrain. It is recommended for use in this situation in the "Guideline on Air Quality Models" (USEPA, 1995a).

The ISC3 model is a steady-state, multiple-source, Gaussian dispersion model designed for use with stack emission sources situated in simple and complex terrain. ISC3 also incorporates complex phenomena such as building-induced plume downwash and the gravitational settling and deposition of particulate matter.

Technical options selected for the ISC3 modeling are listed below. Use of these options follow EPA's modeling guidance and/or sound scientific practice. An explanation of

these options and the rationale for their selection is provided below. The required input options for ISC3 are as follows:

- Final plume rise

- Buoyancy induced dispersion

- Stack tip downwash

- Rural Dispersion Coefficients

- Calm processing

- Default wind profile exponents

- Default vertical temperature gradients

- Anemometer height = 10.0 meters

Final plume rise is recommended by EPA when there is no significant terrain close to the stacks. Buoyancy-induced dispersion, which accounts for the buoyant growth of a plume caused by entrainment of ambient air, was included in the modeling because of the relatively warm exit temperature and subsequent buoyant nature of the exhaust plumes for both projects. Stack-tip downwash, which adjusts the effective stack height downward following the methods of Briggs (1969) for cases where the stack exit velocity is less than 1.5 times the wind speed at stack top, is selected as per EPA guidance.

Based on the land use classification procedure of Auer (1978), land use in the region surrounding the project site is greater than 50 percent rural. Therefore, rural dispersion coefficients were used in the dispersion analyses.

The calm processing option allows the user to direct the program to exclude hours with persistent calm winds in the calculation of concentrations for each averaging period. This option is generally recommended by the EPA for regulatory applications. The ISC3 model recognizes a calm wind condition as a wind speed of 1 meter per second and a wind direction equal to that of the previous hour. The meteorological preprocessor program (RAMMET) automatically makes this assignment to calm hours. The calm processing option in ISC3 then excludes these hours from the calculation of

concentrations.

ISC3 includes building downwash algorithms, where appropriate, in its calculations. This accounts for plumes being affected by downwash regions in the vicinity of buildings and results in plume height reductions and greater initial dispersion. The BEE-Line version of GEP-BPIP was used to determine the building downwash parameters for the over 60 sources in the model runs.

5.1.1 Criteria Pollutant Analysis

Criteria pollutants from all permitted sources were modeled using ISC3. Impacts are compared with the significant impact levels (SILs), NAAQS, Wyoming Ambient Air Quality Standards (WAAQS), Class II PSD Increments, and the de minimis Monitoring Levels. These criteria are summarized in Table 5-1.

Table 5-1: Air Quality Modeling Criteria

Pollutant	Averaging Period	Criteria Concentrations ($\mu g/m^3$)			
		Significant Impact Level	NAAQS/ WAAQS	Class II PSD Increment	De minimis Monitoring Level
PM_{10}	24-hour	5	150	30	10
	Annual	1	50	17	--
CO	1-hour	2,000	40,000	--	--
	8-hour	500	10,000	--	575
NO_X	Annual	1	100	25	14
SO_2	3-hour	25	1300	512	-
	24-hour	5	365	91	13
	Annual	1	80	20	-

There is no modeling requirement in NSR/PSD permitting to demonstrate compliance with the ozone NAAQS. Ozone is an indirect pollutant (i.e., no source emits ozone, but ozone is formed in the atmosphere by a series of very complex photochemical reactions. VOC and NO_X are considered primary precursors to the formation of ozone. Traditionally, VOC has been the primary focus of control strategies intended to reduce ozone, but it is widely recognized that some forms of VOC are much more reactive than others, and NO_X and NH_3 concentrations play an important part in the formation of ozone.

The PSD regulations established significant impact levels (SILs) for all criteria pollutants except for ozone. If impacts from the project are demonstrated to be below the SIL, no

further analysis is required. For ozone, no ambient level was established in recognition of the fact that no reasonable technique is available to estimate the impact from a point source. In lieu of an ambient impact, the PSD regulations established an increase in VOC emission greater than 100 tons per year as the de minimis limit.

In the EPA published Guidance Notebook for New Source Review, only one reference was found to deal with reactive pollutants. In this guidance, EPA referred to "Guidelines for Implementation of a Regional New Source Review Program for Stationary Sources." This resource indicates that

> "Reactive pollutants (HC-O_x and NO_x) are somewhat difficult to deal with at the present time. Existing modeling techniques do not appear to adequately predict the reactive pollutant impact of specific point sources. Since no acceptable modeling is presently possible, the air quality portion of the NSR need not apply if there is no SIP control strategy demonstration for the area."

Currently, modeling for ozone has been related to non-attainment areas, and has involved the use of large scale regional models like the Urban Airshed Model (UAM). The Reactive Plume Model (RPM) may have been used in a few cases, but it is believed to be very conservative and no consensus has been reached concerning the use of RPM for permitting.

The closest monitor for ozone is north of Pinedale, Wyoming. Typically, the chemical reaction to convert emissions to ozone requires approximately 20 to 45 minutes. This monitor is at a distance that would allow a transport time typically greater than 20 minutes and would therefore allow the reaction to take place. This monitor has recorded a maximum ozone concentration of 110 $\mu g/m^3$. Many factors contribute to this ozone concentration. It is very conservative to assume that this ambient level is formed entirely by emissions from soda ash production.

The U.S. Bureau of Mines publishes yearly production rates from the five local soda ash producers. In 1996, approximately 10 MM tons of soda ash were produced from approximately 20 MM tons of trona ore. SSAJV's proposed expansion will produce an additional 1.2 MM TPY of soda ash from approximately 2 MM tons of trona ore. The increase in VOC emissions associated with this project are approximately ten percent of the existing baseline. Under that conservative assumption, an equivalent change could occur in the ambient ozone concentration. Based on this approach, this project will not result in an exceedance of the Wyoming Standard of 160 μg/m^3. This will also not result in an exceedance of the Federal Standard of 235 μg/m^3.

5.1.1.1 AAQS Analysis

The EPA has defined a set of significant impact levels (SILs) which are used to determine whether a detailed air quality impact analysis needs to be performed to assess attainment of the Ambient Air Quality Standards (AAQS). By modeling projected air quality impacts, if impacts from the proposed modifications exceeds the SILs for any of the criteria pollutants, then an AAQS compliance demonstration must be performed.

To demonstrate compliance with the AAQS, impacts from the proposed projects must be modeled and added to regional background levels. This total concentration is then compared to the AAQS to assess attainment.

Compliance with AAQS requires the inclusion of background emissions. Monitored data has been obtained to represent the background. Upwind PM$_{10}$ monitor data collected at the SSAJV facility is presented in Table 5-2.

Table 5-2: PM$_{10}$ Background Monitored Data

(μg/m^3)

Year	24-hour		Annual
	High	Second-High	
1994	41	34	11.25
1995	57	24	9.72
1996	27	26	10.02
3-year Maximum	**57**	**34**	**11.25**

A background value for NO$_X$ of 3.0 μg/m^3 was taken from 1993 measurements at the Chevron Phosphate Plant, south of Rock Springs. (This value has been used in previous air quality permit applications.)

5.1.1.2 PSD Compliance Analysis

For sources located in an attainment area, PSD review includes a Best Available Control Technology (BACT) analysis, NAAQS compliance demonstration, air quality increment analysis, assessment of Class I and Class II impacts, and an assessment of air quality related values.

If a source emits, or has the potential to emit, over 100 tons per year (TPY) of any pollutant subject to regulation under the CAA and is one of the specific source categories listed in the federal PSD regulations, the source is considered a major source [40 CFR 52.21 (b)(23)(i)]. All the sources that do not fall under the specific source category listing are evaluated against a 250 TPY major source threshold to determine PSD applicability. The SSAJV facility is a major source as defined under the PSD regulations.

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For each pollutant subject to PSD review, the air quality analysis must determine AAQS compliance, as discussed above, and must evaluate the amount of PSD increment that is available to the new source, as well as the potential amount of increment that the new source is expected to consume. Only PM_{10} meets these requirements.

5.1.2 HAPs Analysis

HAP emissions from sources #17, 48, 80, and the mine exhaust were modeled. Results from this modeling are compared with the lowest and highest allowable ambient levels (AALs) from all existing state programs, as determined from a survey of EPA's NATICH bulletin board. A summary of the lowest and highest allowable ambient HAP levels (AALs) are shown in Tables 5-4 and 5-5, respectively.

A risk assessment was conducted on the HAPs which are suspected carcinogens. The unit risk factors associated with these compounds (from the IRIS data base) were multiplied to the modeled annual concentrations and multiplied by one million. The result is the risk of contracting cancer on the basis of one in a million. The calculated risk of the applicable HAPs is shown in Section 6, Table 6-6.

Table 5-3: NATICH Lowest Allowable Ambient HAP Levels

	Lowest AALs (µg/m3)			
	1-hour	8-hour	24-hour	Annual
ACETALDEHYDE	90	900	4.89	0.45
ACETOPHENONE	150	-	40	49
ACROLEIN	2.3	2.3	0.6	0.0004
ACRYLONITRILE	21	21.5	1.18	0.0147
BENZENE	30	30	1.74	0.1
BIPHENYL	2.3	13	0.34	0.01
BIS(2-ETHYLHEXYL)PHTHALATE	50	50	4	0.2
1,3 BUTADIENE	7.2	220	1.2	0.003
2-BUTANONE	3900	5900	32.1	32.1
CUMENE	500	2450	588	0.009
ETHYL BENZENE	2000	4340	118	118
FORMALDEHYDE	15	4.5	0.033	0.004
HEXANE	1760	1800	432	176
METHYLENE CHLORIDE	260	870	9.45	0.2
NAPHTHALENE	440	500	120	14
PHENOL	154	95	45.6	10
PROPIONALDEHYDE	21	4290	-	-
STYRENE	215	1070	116	1.75
TOLUENE	1880	1870	10.2	10.2
1,1,1-TRICHLOROETHANE	10800	4550	1040	1000
TRICHLOROETHENE	1100	1350	36.5	0.42
XYLENE	2079	2170	3500	434

Table 5-4: NATICH Highest Allowable Ambient HAP Levels

	Highest AALs (µg/m3)			
	1-hour	8-hour	24-hour	Annual
ACETALDEHYDE	2700	4290	18000	600
ACETOPHENONE	490	-	4910	100
ACROLEIN	*80	6.9	6	0.83
ACRYLONITRILE	43	107	43	15
BENZENE	630	714	320	100
BIPHENYL	2.3	36	126	5
BIS(2-ETHYLHEXYL)PHTHALATE	100	119	200	120
1,3 BUTADIENE	110	52400	528	11
2-BUTANONE	*89000	11800	59000	1970
CUMENE	500	5860	24600	245
ETHYL BENZENE	*54000	43500	7200	5430
FORMALDEHYDE	*150	71	12	7.69
HEXANE	5300	36000	29000	200
METHYLENE CHLORIDE	17400	8330	8750	8440
NAPHTHALENE	*7900	1190	50000	167
PHENOL	950	1900	456	456
PROPIONALDEHYDE	21	4290	-	-
STYRENE	*42500	5120	21300	716
TOLUENE	*56000	8930	37700	7500
1,1,1-TRICHLOROETHANE	*250000	190000	191000	38000
TRICHLOROETHENE	10700	6430	134000	6840
XYLENE	6510	4400	7200	434

* 15-minute average

5.2 METEOROLOGICAL DATA

EPA modeling guidelines require that either one year of on-site meteorological data or five years of representative off-site meteorological data be used in an air quality analysis (USEPA, 1995a).

Five years of meteorological data, obtained from the EPA BBS for the years 1987-1991 is used in this analysis. Surface data was obtained for Rock Springs and upper air data from Lander, Wyoming. This data was processed using the EPA's PCRAMMET program. This program is used to generate stability classes from the surface and upper air data and to interpolate the twice daily mixing heights for each hour.

5.3 SOURCE CHARACTERISTICS

5.3.1 Stack Parameters

Stack parameters and emission rates are based on permitted, or to be permitted, values. Stack parameters used in the modeling analysis are presented in Table 5-5. Emission rates are presented in Table 5-6.

Table 5-5: Stack Parameters

AQD #	Name	Location (UTM)		Stack Height		Diameter	Temp	Velocity
	Existing	East	North	feet	meters	meters	K	m/s
2a	Ore crusher	603661.2	4594979.9	23	7.01	1.06	293.2	15.85
2b	Ore reclaim	603749.6	4595001.2	38	11.58	0.33	293.2	27.74
6a	Top silos	603892.8	4594835.1	133	40.54	0.64	308.7	24.99
6b	Silo reclaim	603900.4	4594810.7	15.5	4.72	0.67	297.0	10.06
7	PLO	604045.2	4594861.0	82	24.99	0.75	293.2	19.51
10	Coal crushing	603865.4	4594992.1	13.3	4.05	0.60	293.2	5.49
11	Coal transfer	603873.0	4594819.9	35.3	10.76	0.55	293.2	6.40
14	Boiler coal bunker	603760.2	4594807.7	125	38.10	0.43	293.2	17.37
15	DR 1&2	603719.1	4594813.8	180	54.86	1.83	347.0	14.94
16	Product classifier	603722.1	4594824.5	126	38.40	1.07	369.3	12.80
17	CA 1&2	603685.5	4594807.7	180.5	55.02	3.66	463.7	13.41
18	BO-1	603834.9	4594807.7	180.5	55.02	2.21	324.8	17.68
19	BO-2	603834.9	4594780.3	180.5	55.02	2.21	322.0	18.29
24	Boiler fly ash silo	603819.7	4594786.4	25	7.62	0.30	301.5	12.50
25	AT crush and screen	603665.7	4595011.9	76	23.16	0.73	293.2	14.63
26	AT Dryer	603673.4	4594984.5	67	20.42	0.73	310.9	17.68
27	AT Bagging & Loadout	603697.7	4594975.3	60	18.29	0.48	293.2	18.90
28	Fluid Bed Dryer	603725.2	4594836.7	140	42.67	1.22	347.0	12.19
30	Lime Bin #1	603938.5	4594768.1	88	26.82	0.20	279.3	17.98
31	Lime Bin #2	603938.5	4594746.7	88	26.82	0.20	279.3	17.98
33	Sulfur Burner	603889.8	4594723.9	100	30.48	0.61	338.7	10.67
35	Sulfite Dryer	603929.4	4594725.4	103	31.39	0.70	327.0	14.63
36	Sulfite Bin #1	603929.4	4594702.5	60	18.29	0.15	338.2	25.88
37	Sulfite Bin #2	603943.1	4594702.5	60	18.29	0.15	338.2	25.88
P38	Sulfite Bin #3	603959.9	4594702.5	60	18.29	0.15	338.2	25.88
39	Sulfite Bin #4	603973.6	4594702.5	60	18.29	0.15	338.2	25.88
40	Sulfite Bagging	603953.8	4594733.0	60	18.29	0.30	338.2	15.54
41	Sulfite Loadout	603987.3	4594723.9	70	21.34	0.30	338.2	21.34
44	Lime Unloading	603870.0	4594748.3	30	9.14	0.46	279.3	18.59
45	AT Transloading	604030.0	4594847.3	17.8	5.43	0.27	293.2	8.84
46	Trona Transfer	603764.8	4594983.0	12.5	3.81	0.67	293.2	14.02
47	Exp Crusher	603649.0	4594992.1	125	38.10	1.37	293.2	13.72
48	CA-3	603685.5	4594845.8	180	54.86	3.20	449.8	9.75
50	Dryer Area	603713.0	4594847.3	180	54.86	1.37	366.5	8.23
51	DR-5	603738.9	4594838.2	180	54.86	2.44	422.0	10.06
52	Silo Top #2	603898.9	4594883.9	141	42.98	0.46	293.2	15.24
55	Ore recycle/reclaim	603600.2	4594984.5	64	19.51	0.40	293.2	15.24
62	Carbon Silo	603639.8	4594740.6	91	27.74	0.15	293.2	25.91
63	Perlite Silo	603652.0	4594737.6	58	17.68	0.15	293.2	31.09

AQD #	Name	Location (UTM)		Stack Height		Diameter	Temp	Velocity
		East	North	feet	meters	meters	K	m/s
64	Sulfite Blending #2	603973.6	4594690.4	15	4.57	0.15	293.2	29.26
65	Sulfite Blending #1	603959.9	4594690.4	35	10.67	0.23	293.2	4.57
66	Carbon/Perlite Scrubber	603705.4	4594771.1	125	38.10	0.30	293.2	22.86
67	Bottom Ash	603629.2	4594801.6	125	38.10	0.46	310.9	10.06
68	Bagging Trona Silo	603929.4	4594835.1	82	24.99	0.37	293.2	23.47
70	Bagging Sulfite Silo	603929.4	4594845.8	82	24.99	0.40	293.2	14.94
71	Bagging MBS Silo	603944.6	4594845.8	82	24.99	0.40	293.2	14.94
72	MBS Soda Ash Feed	603897.4	4594714.7	60.67	18.49	0.20	366.5	16.15
73	MBS Dryer	603885.2	4594714.7	95	28.96	0.61	305.4	17.07

New expansion sources

AQD #	Name	Location (UTM)		Stack Height		Diameter	Temp	Velocity
74	North Headframe	603507.2	4594999.7	105	32.00	0.41	288.7	18.19
75	Primary Crushing	603505.7	4595045.4	25	7.62	0.41	288.7	18.19
76	Primary Screening	603502.7	4594970.8	25	7.62	1.35	288.7	17.91
77	Transfer 101	603586.5	4594979.9	40	12.19	0.33	288.7	17.91
78	Transfer 102	603554.5	4594954.0	70	21.34	0.38	288.7	16.56
79	Transfer Point	603588.0	4594954.0	70	21.34	0.33	288.7	16.54
80	Calciner #4	603655.1	4594877.8	180	54.86	3.00	443.2	17.66
81	Product Dryer Area	603766.3	4594835.1	180	54.86	1.09	394.3	17.63
82	Dryer #6	603781.6	4594832.1	180	54.86	2.16	424.8	17.79
83	Silo Top	603953.8	4594882.4	130	39.62	0.43	366.5	17.08
84	Silo Bottom	603953.8	4594838.2	50	15.24	0.61	366.5	17.79
85	Industrial Boiler	603684.0	4594822.9	140	42.67	0.91	435.9	15.24
MV	Mine Exhaust Vent	603286.3	4594864.1	Volume Source				

Table 5-6: Emission Rates (Pounds per Hour)

AQD	Existing	PM$_{10}$	NO$_x$	SO$_2$	CO	VOC
2a	ore crusher	1.60				
2b	ore reclaim	0.0				
6a	top silos	0.30				
6b	silo reclaim	0.51				
7	PLO	1.20				
10	coal crushing	0.60				
11	Coal transfer	0.21				
14	boiler coal bunker	0.37				
15	DR 1&2	6.80	1.20			
16	product classifier	0.90				
17	CA 1&2	22.30	25		1524	776
18	BO-1	10.0	245	70	17.5	0.50
19	BO-2	10.0	245	70	17.5	0.50
24	boiler fly ash silo	0.30				
25	AT crush and screen	1.00				
26	AT Dryer	1.10	0.05		0.07	
27	AT Bagging & Loadout	0.50				
28	Fluid Bed Dryer	2.90				
30	Lime Bin #1	0.20				
31	Lime Bin #2	0.20				
33	Sulfur Burner		1.50	0.40		
35	Sulfite Dryer	1.40				
36	Sulfite Bin #1	0.10				
37	Sulfite Bin #2	0.10				
38	Sulfite Bin #3	0.10				
39	Sulfite Bin #4	0.10				
40	Sulfite Bagging	0.00				
41	Sulfite Loadout	0.19				
44	Lime Unloading	0.90				
45	AT Transloading	0.20				
46	Trona Transfer	0.71				
47	Exp Crusher	2.90				
48	CA-3	9.34	12.5		762	388
50	Dryer Area	1.39				
51	DR-5	4.80	18.0		2.40	
52	Silo Top #2	0.50				
53	Silo Bottom #2	0.90				
54	T-200 Silo	0.19				
55	Ore recycle/reclaim	0.40				

AQD #		PM$_{10}$	NO$_X$	SO$_2$	CO	VOC
62	Carbon Silo	0.13				
63	Perlite Silo	0.17				
64	Sulfite Blending #2	0.15				
65	Sulfite Blending #1	0.06				
66	Carbon/Perlite Scrubber	0.58				
67	Bottom Ash	0.47				
68	Bagging Trona Silo	0.36				
70	Bagging Sulfite Silo	0.27				
71	Bagging MBS Silo	0.27				
72	MBS Soda Ash Feed	0.11				
73	MBS Dryer	1.20	0.15	0.77		
MV	Mine Exhaust Vent				3.75	115.0
	Expansion sources					
74	North Headframe	0.34				
75	Primary Crushing	0.34				
76	Primary Screening	3.70				
77	Transfer BH 101	0.22				
78	Transfer BH 102	0.27				
79	Transfer Point	0.21				
80	Calciner #4 ESP	11.93	20.0	0.0	1047.75	533.5
81	Product Dryer Area BH	1.74				
82	Dryer #6 ESP	4.08	30.0	0.0	14.0	0.27
83	Silo Top	0.29				
84	Silo Bottom	0.59				
85	Industrial Boiler	0.48	3.80	0.06	9.0	0.28

Sources can be modeled as points, areas, or volumes depending on the type of source and emission point. Point sources are used to model stack releases and incorporate plume rise. Area sources represent fugitive releases from flat sources such as evaporation from a pond. Volume sources also represent releases from non-stack sources and incorporate the initial vertical extent of the release.

All stacks and vents were modeled as point sources. This includes all of the facility's sources except the mine ventilation shaft (MV). This source was modeled as a volume source to accurately represent initial lateral and vertical dimensions of the release from

the source.

The mine exhaust is modeled as a volume source to account for the large initial horizontal mixing from the horizontally oriented vent. Exhaust from the existing vent can be felt at ground level at a distance of up 250 feet. The initial lateral extent of the mine exhaust source is based on this distance. The vertical extent of the mine exhaust vent source is 16 feet, based on the height of the top of the vent from the ground.

5.3.2 Good Engineering Practice Stack Height Analysis

Due to the proximity of structures and buildings to the stack sources, the potential for downwash effects were evaluated to assess close-in ambient air impacts. The formula for GEP height estimation is:

$$H_s = H_b + 1.50L_b$$

Where:

H_s - GEP stack height

H_b - Building height

L_b - The lesser building dimension of the height, length, or width

To determine whether or not a structure (building) potentially affects pollutant dispersion from a nearby emission source, EPA provides specific guidance. The guidance states that, if a structure is located within a certain distance from the emission source (stack), downwash effects on the dispersion of stack emissions must be considered. The distance criteria are the following:

- The emission source is within five times the lesser of the structure height or width when the source is downwind of the structure;

- The emission source is within two times the lesser of the structure height or width when the source is upwind of the structure; and

- The emission source is within one-half the lesser of the structure height or

width when the emission source is adjacent to a structure, regardless of the wind flow trajectory.

To determine which structures on-site could induce downwash, an initial screening was performed. Plot plans were reviewed to see if the buildings met any of the distance criteria outlined above. Based on the initial screening for the relationship of sources to the location of plant structures, the locations and dimensions of emission sources and plant structures were input to a software package developed by Bowman Engineering that evaluates building downwash. The GEP-Building Profile Input Program (GEP-BPIP) was used to calculate the direction-specific building dimensions for input into the ISC3 model. GEP-BPIP was designed to incorporate the concepts and procedures expressed in the GEP technical support document (USEPA, 1985).

For refined modeling analyses, EPA guidelines require that wind direction-specific building dimensions be input from results of the GEP-BPIP runs for each source affected by building downwash. This will account for the source orientation with respect to a particular building using the Schulman-Scire building downwash algorithm within ISC3. This allows the model to compare downwash from different structures depending on different wind directions. The structure width of the applicable structure is measured at each specified 10° interval (i.e., from 10° clockwise to 360°) by projecting a perpendicular line to an individual wind direction and noting the length of this line from one edge of the structure to the other. Thus, the projected structure width varies by wind direction, while the structure height remains the same. The ISC3 model internally checks whether the stack height of the emission source is less than the building heights plus one-half times the lesser of the building height or width. If this condition is not satisfied, then the model defaults to the Huber-Snyder building downwash algorithm and only one set of building dimensions is applied through all wind directions.

Building dimensions, and resulting GEP formula heights, are presented in Table 5-7.

Table 5-7: Preliminary GEP Analysis

Building Name	Height (feet)	Width (or Diameter) (feet)	Length (feet)	MPW (feet)	L (feet)	GEP Formula (feet)	3L (feet)	5L (feet)	Include in GEP-BPIP Analysis?
Product Silos	144	120	120	170	144	360	432	720	Y
Crystallization Area	120	75	280	290	120	300	360	600	Y
Drying Area	120	50	180	187	120	300	360	600	Y
Steam Plant	115	152	165	224	115	288	345	575	Y
Soda Ash Plant	115	375	400	548	115	288	345	575	Y
Product Storage Silos	110	160	160	226	110	275	330	550	Y
Product Loadout Station	106	52	94	107	106	265	318	530	Y
Primary Screening	105	54	96	110	105	263	315	525	Y
Caustic/Sulfite Plant	93	150	355	385	93	233	279	465	Y
South Headframe	168	30	30	42	42	232	127	212	Y
North Headframe	168	30	30	42	42	232	127	212	Y
West Ore Storage	65	120	400	418	65	163	195	325	Y
Ore Storage Building	63	123	700	711	63	158	189	315	Y
Coal Storage	63	123	510	525	63	158	189	315	Y
Plant Condensate Tank	55	80		80	55	138	165	275	Y
Primary Crushing	58	34	34	48	48	130	144	240	Y
Ore Crushing Station	60	22	34	40	40	121	121	202	Y
Transfer Tower No. 1	75	20	20	28	28	117	85	141	Y
Mine Water	45	45		45	45	113	135	225	Y
Transfer Tower No. 3	70	20	20	28	28	112	85	141	Y
Transfer Tower No. 4	70	20	20	28	28	112	85	141	Y
North Hoist House (assumed same as S.HH)	41	56	100	115	41	103	123	205	Y
South Hoist House	41	56	100	115	41	103	123	205	Y
Cooling Tower	40	30	90	95	40	100	120	200	Y
Unloading Station	38	27	63	69	38	95	114	190	Y
Primary Filter Feed	37	70		70	37	93	111	185	Y
Mine Water	37	48		48	37	93	111	185	Y
Primary Filter Feed Tank	37	70		70	37	93	111	185	Y
Tank - 75	37	70		70	37	93	111	185	Y
Transfer Tower No. 2	40	20	20	28	28	82	85	141	Y
Primary Thickener	26	220		220	26	65	78	130	Y

Building Name	Height (feet)	Width (or Diameter) (feet)	Length (feet)	MPW (feet)	L (feet)	GEP Formula (feet)	3L (feet)	5L (feet)	Include in GEP-BPIP Analysis?
Primary Thickener	19	120		120	19	48	57	95	Y
Metering Station		50	100	112	112	168	335	559	N
Coal Storage - Tower	74	31	33	45	45	142	136	226	N
Ore Storage - Tower	74	31	33	45	45	142	136	226	N
Clear Liquor Tank	55	110		110	55	138	165	275	N
Tank-96	40	55		55	40	100	120	200	N
Weak Liquor Tank	37	70		70	37	93	111	185	N
Process Water Tank	37	70		70	37	93	111	185	N
Crystallizer Wash	37	70		70	37	93	111	185	N
Tank-92	37	70		70	37	93	111	185	N
Tank-73	37	70		70	37	93	111	185	N
Thickening & Pumphouse	36	43	72	84	36	90	108	180	N
Change House, Shop, & Warehouse	35	200	325	382	35	88	105	175	N
Weak Liquor	35	70		70	35	88	105	175	N
Admin. Buildings	31	117	202	233	31	78	93	155	N
Maintenance Warehouse	25	75	100	125	25	63	75	125	N
Secondary Thickener	23	160		160	23	58	69	115	N
Tank-11	23	160		160	23	58	69	115	N
Change House	15	55	95	110	15	38	45	75	N
Plant Main Substation	12	22	65	69	12	30	36	60	N

Inputs and outputs from the GEP-BPIP analysis are presented in the enclosed computer disks.

5.4 RECEPTOR SELECTION

The receptor grid is divided into two primary groups: property receptors and a Cartesian grid.

Based on agency guidance, property receptors were placed at a distance of 500 meters from the nearest source. A rectangular array was defined by placing the western edge 500 meters west of the western-most source (the mine exhaust vent), the eastern edge 500 meters east of the eastern-most source (the product loadout), and doing the same for the north and south edges. All receptors were given the same base elevation as the facility sources to represent the flatness of the area around the SSAJV plant.

A 10 kilometer square area surrounding the plant was covered with a 500 meter Cartesian grid. Receptor elevations for the Cartesian grid were determined using digital terrain data obtained from Bowman Engineering. Each receptor is assigned the maximum elevation within a 500 meter square centered on the receptor.

No receptors were placed inside the property receptors.

5.5 AIR QUALITY RELATED VALUES

In addition to the NAAQS, PSD, and HAPs analyses, air emissions from the SSAJV facility were evaluated with respect to impacts on surrounding Class I Area, Air Quality Related Values (AQRVs). These impacts include plume visibility, regional haze, and acid deposition.

5.5.1 Plume Visibility

A plume has the potential to impact scenic vistas at nearby Class I Areas. For a given scenic vista, plume visibility is estimated using the EPA VISCREEN model. The EPA's

VISCREEN model was used for these analyses, following EPA guidance as set forth in the Tutorial Package for the VISCREEN MODEL (EPA, June 1992).

The perceptibility of a plume is defined by two parameters: contrast and color difference, or Delta E. A contrast of 0.02 (where 1.0 would be a black/white contrast) and a Delta-E of 1 are generally assumed to be the threshold of human perceptibility. The screening criteria that VISCREEN uses are a contrast of 0.05 and a Delta-E of 2.0

A Level 1 screening analysis is performed assuming meteorological data of stability F and a wind speed of 1.0 m/s. If compliance cannot be shown with a Level 1 analysis, a Level 2 analysis is performed. In a Level 2 analysis, actual meteorological data is assessed and the "worst" one percent of the data is eliminated, giving more realistic meteorological data. In addition, the Stability is shifted one stability less stable to account for the elevation change between the source and the Class I area.

5.5.2 Regional Haze

Particulate and NO_x emissions can contribute to the formation of regional haze and impair the general visibility in a region.

IWAQM guidance provides for a screening method to estimate regional haze impacts based on 24-hour modeled impacts. Air quality impacts, as modeled by ISC3, are used in the regional haze calculation.

5.5.3 Acid Deposition

NO_x and SO_2 emissions have the potential to convert to nitrates and sulfates and be deposited into sensitive lakes, ponds, and other water bodies. This can increase the acidity of these water bodies. Following the screening procedure described in the Interagency Workgroup on Air Quality Models (IWAQM) acid deposition in several area lakes was assessed. The lakes considered in this analysis, along with their location and baseline acid neutralization capacity (ANC) are given in Table 5-8. These lakes were suggested for analysis by Ann Mebane of the U.S. Forest Service in Pinedale, Wyoming.

Table 5-8: Lakes Considered in Acid Deposition Analysis

Lake	UTM Coordinates (meters)		Elevation		ANC
	Easting	Northing	(feet)	(meters)	
Black Joe Lake	650,500	4,733,100	10,259	3,127	46
Deep Lake	648,600	4,731,400	10,502	3,201	40
Hobbs Lake	608,200	4,765,400	10,060	3,066	57
Ross Lake	609,000	4,805,300	9,675	2,949	51
Saddlebag Lake	644,400	4,720,800	11,262	3,433	28.4
Klondike Lake	611,000	4,787,500	11,215	3,418	20
Upper Titcomb Lake	640,500	4,717,500	10,597	3,230	34

6. RESULTS

6.1 IMPACTS DUE TO EXPANSION

As part of the modeling analysis, just those impacts from the proposed expansion are compared with de minimis monitoring levels and significant impacts levels (SILs). Impacts greater than the de minimis monitoring levels indicate the need for preconstruction monitoring data to be collected (or a reasonable substitute to be available). If impacts are shown to be above the SILs then a cumulative impact analysis is required to demonstrate compliance with the NAAQS, WAAQS, and PSD increment.

Table 6-1 presents the modeling results for impacts due to emissions from the facility expansion. Maximum impacts for each averaging period is shown in this table. Figures 6.1 and 6.2 depict isopleths of the PM_{10} dispersion modeling results on an annual and 24 hour basis, respectively.

Table 6-1: Maximum Impacts from Emissions Due to Expansion

Pollutant	Averaging Period	Year	Modeled Impacts ($\mu g/m^3$)	Significant Impact Level ($\mu g/m^3$)	de minimis Monitoring Level ($\mu g/m^3$)
PM$_{10}$	24-hour	1987	28.9	5	10
		1988	36.8	5	10
		1989	30.4	5	10
		1990	34.7	5	10
		1991	33.1	5	10
	Annual	1987	7.9	1	
		1988	8.6	1	
		1989	8.3	1	
		1990	7.5	1	
		1991	8.8	1	
CO	1-hour	1987	855	2000	
		1988	902	2000	
		1989	985	2000	
		1990	836	2000	
		1991	805	2000	
	8-hour	1987	195	500	575
		1988	274	500	575
		1989	240	500	575
		1990	249	500	575
		1991	261	500	575

Table 6-1 (Continued)

Maximum Impacts from Emissions Due to Expansion

Pollutant	Averaging Period	Year	Modeled Impacts ($\mu g/m^3$)	Significant Impact Level ($\mu g/m^3$)	de minimis Monitoring Level ($\mu g/m^3$)
SO_2	3-hour	1987	0.089	25	
		1988	0.110	25	
		1989	0.130	25	
		1990	0.110	25	
		1991	0.120	25	
	24-hour	1987	0.021	5	13
		1988	0.020	5	13
		1989	0.021	5	13
		1990	0.020	5	13
		1991	0.022	5	13
	Annual	1987	0.0034	1	
		1988	0.0037	1	
		1989	0.0038	1	
		1990	0.0033	1	
		1991	0.0039	1	
NO_x	Annual	1987	1.42	1	14
		1988	1.75	1	14
		1989	1.51	1	14
		1990	1.34	1	14
		1991	1.41	1	14

Modeled CO impacts due to the expansion, are below both the SILs and the de minimis monitoring levels. Therefore, no further analyses are required for CO.

Modeled PM_{10} impacts exceed both the SIL and de minimis levels. The preconstruction monitoring requirement for PM_{10} will be met by using the existing PM_{10} monitoring network at the SSAJV facility. AAQS and PSD increment compliance is demonstrated below.

6.2 AAQS COMPLIANCE ASSESSMENT

Those pollutants which show impacts in excess of the SILs are included in a cumulative AAQS compliance demonstration. As discussed in Section 5, modeled high-second high impacts for the entire SSAJV facility (existing and expansion sources) are combined with monitored background levels for comparison with the NAAQS and the WAAQS. Only PM_{10} and NO_x impacts were required to be included in this analysis. The results of this analysis are shown in Table 6.2.

Table 6-2: NAAQS/WAAQS Compliance Demonstration

Pollutant	Averaging Period	Year	SSAJV Impact (HSH) ($\mu g/m^3$)	Monitored Impact ($\mu g/m^3$)	Cumulative Impact ($\mu g/m^3$)	AAQS ($\mu g/m^3$)
PM_{10}	24-hour	1987	24.6	34	58.6	150
		1988	29.1	34	63.1	150
		1989	28.1	34	62.1	150
		1990	28.4	34	62.4	150
		1991	27.7	34	61.7	150
	Annual	1987	7.9	11	18.9	50
		1988	8.6	11	19.6	50
		1989	8.3	11	19.3	50
		1990	7.5	11	18.5	50
		1991	8.8	11	19.8	50
NO_x	Annual	1987	32.9	3	35.9	100
		1988	36.8	3	39.8	100
		1989	38.1	3	41.1	100
		1990	36.2	3	39.2	100
		1991	40.0	3	43.0	100

6.3 PSD INCREMENT ANALYSIS

Those pollutants with PSD Increments that have modeled impacts that exceed the SILs (PM_{10}) are included in the PSD Increment Analysis. The increment analysis includes all sources permitted after the PSD baseline was triggered. This includes all of the SSAJV facility. The results of this analysis are shown in Table 6.3.

Table 6-3: Class I PSD Increment Analysis

Pollutant	Averaging Period	Year	SSAJV Impact (HSH) ($\mu g/m^3$)	PSD Class II Increment ($\mu g/m^3$)
PM_{10}	24-hour	1987	24.6	30
		1988	29.1	30
		1989	28.1	30
		1990	28.4	30
		1991	27.7	30
	Annual	1987	7.9	17
		1988	8.6	17
		1989	8.3	17
		1990	7.5	17
		1991	8.8	17

6.4 HAPS

1-hour, 8-hour, 24-hour, and annual impacts for all hazardous air pollutant (HAP) emissions from the SSAJV facility are shown in Table 6-4. These results are compared with the highest and lowest allowable ambient levels (AALs) presented in Section 5, Tables 5-3 and 5-4. Table 6-5 depicts the status of the levels. As can be seen, the result of most HAPs are below the lowest AALs for all of the states. For some HAPs and some averaging periods, the modeled results are greater than the lowest AALs, but below the highest AALs.

The calculated risk of the HAPs that are considered carcinogens are shown in Table 6-6. The maximum estimated risk is that of 1,3 Butadiene at 7.56×10^{-5} or 76 chances in a million.

Table 6-4: Summary of HAP Modeling - Five Year Maximum Impact

(1987 - 1991 Rock Springs Meteorological Data)

	5-Year Maximum Impacts ($\mu gm/m^3$)			
	1-hour	8-hour	24-hour	Annual
ACETALDEHYDE	0.48	0.15	0.077	0.0071
ACETONE	0.33	0.1019	0.057	0.0050
ACETOPHENONE	0.032	0.010	0.0052	0.00048
ACROLEIN	1.23	0.37	0.20	0.018
*ACRYLONITRILE	1.52	0.46	0.26	0.023
BENZENE	25.29	7.72	3.97	0.37
BIPHENYL	0.046	0.014	0.0073	0.00068
BIS(2-ETHYLHEXYL)PHTHALATE	0.0030	0.00092	0.0005	0.00004
1,3 BUTADIENE	18.55	5.66	2.88	0.27
2-BUTANONE	4.74	1.45	0.82	0.072
2-CHLOROACETOPHENONE	0.0030	0.00092	0.0005	0.00004
CUMENE	0.004	0.0011	0.0006	0.00005
DI-N-BUTYLPHTHALATE	0.023	0.0071	0.0037	0.00034
DIBENZOFURAN	0.039	0.012	0.0062	0.00058
ETHYL BENZENE	2.51	0.76	0.42	0.038
FORMALDEHYDE	0.34	0.11	0.059	0.0050
HEXANE	7.85	2.40	1.24	0.116
*METHYLENE CHLORIDE	1.10	0.33	0.16	0.016
3/4 METHYLPHENOL	0.019	0.0058	0.0031	0.00028
N,N-DIMETHYLANILINE	0.016	0.0049	0.0026	0.00024
NAPHTHALENE	0.30	0.09	0.048	0.0044
PHENOL	0.18	0.056	0.029	0.0027
PROPIONALDEHYDE	0.14	0.042	0.022	0.0021
STYRENE	4.59	1.40	0.72	0.068
TOLUENE	10.47	3.19	1.69	0.156
*1,1,1-TRICHLOROETHANE	8.85	2.70	1.31	0.129
*TRICHLOROETHENE	9.11	2.84	1.57	0.135
XYLENE	13.87	4.23	2.25	0.207

* These four compounds may have been misidentified during the GC stack test, the more accurate GC/MS did not identify these compounds. However, they have been included in the permit analysis.

Table 6-5: Summary of HAP Modeling - Status of Modeled Values vs. State Regulations

	Status			
	1-hour	8-hour	24-hour	Annual
ACETALDEHYDE	Below	Below	Below	Below
ACETOPHENONE	Below	N/A	Below	Below
ACROLEIN	Below	Below	Below	Between
*ACRYLONITRILE	Below	Below	Below	Between
BENZENE	Below	Below	Between	Between
BIPHENYL	Below	Below	Below	Below
BIS(2-ETHYLHEXYL)PHTHALATE	Below	Below	Below	Below
1,3 BUTADIENE	Between	Below	Between	Between
2-BUTANONE	Below	Below	Below	Below
CUMENE	Below	Below	Below	Below
ETHYL BENZENE	Below	Below	Below	Below
FORMALDEHYDE	Below	Below	Between	Between
HEXANE	Below	Below	Below	Below
*METHYLENE CHLORIDE	Below	Below	Below	Below
NAPHTHALENE	Below	Below	Below	Below
PHENOL	Below	Below	Below	Below
PROPIONALDEHYDE	Below	Below	N/A	N/A
STYRENE	Below	Below	Below	Below
TOLUENE	Below	Below	Below	Below
*1,1,1-TRICHLOROETHANE	Below	Below	Below	Below
*TRICHLOROETHENE	Below	Below	Below	Below
XYLENE	Below	Below	Below	Below

* These four compounds may have been misidentified during the GC stack test, the more accurate GC/MS did not identify these compounds. However, they have been included in the permit analysis.

Table 6-6: Calculated Risk

HAP Pollutant	Unit Risk Factor	Maximum Modeled Annual Concentration ($\mu g/m^3$)	Calculated Risk
*Acrylonitrile	6.8×10^{-6}	0.023	1.56×10^{-7}
Benzene	8.3×10^{-6}	0.37	3.07×10^{-6}
Bis(2-Ethylhexyl)phthalate	2.4×10^{-7}	0.00004	9.6×10^{-12}
1,3 Butadiene	2.8×10^{-4}	0.27	7.56×10^{-5}
Formaldehyde	1.3×10^{-5}	0.005	6.5×10^{-8}
*Methylene Chloride	4.1×10^{-6}	0.016	6.56×10^{-8}
*Trichloroethene	1.3×10^{-6}	0.135	1.76×10^{-7}

* These compounds may have been misidentified during stack testing utilizing the GC, the more accurate GC/MS results have not revealed these HAPs. However, they have been included in the permit analysis.

6.5 Plume Visibility

One of two ways to measure the effects of air emissions on visibility is to determine the perceptibility of the plume at a Class I Area. The EPA's VISCREEN model is used to determine plume perceptibility using two criteria: plume perceptibility (delta E) and plume contrast. These parameters are calculated by VISCREEN for vistas looking inside the Class I Area and looking outside the Class I Area. For this analysis, these criteria are only assessed inside the Class I Area. The VISCREEN model was used with the following inputs:

- 812 tons per year particulate emissions,
- Background Visual Range of 262 kilometers,
- Source Observer distance of 130 kilometers,
- Minimum Distance of 130 kilometers, and
- Maximum Distance of 145 kilometers.

An initial Level One analysis (using worst-case meteorological conditions) did not show compliance with the screening criteria used by VISCREEN.

Following the guidance in the EPA's Tutorial Package for the VISCREEN Model, the five-year meteorological data set was analyzed to determine what meteorological conditions should be used in the Level Two analysis. In addition, as recommended in the Tutorial Package, stabilities were shifted one level less stable (i.e. D was changed to C) to account for the elevation change between the source and the Class I Area. The Level Two analysis did show compliance with screening criteria for visual impacts inside the Class I Area.

6.6 Regional Haze

The condensible emission rates were added to PM_{10} emission rates and input to the ISCST3 model and modeled to the Class I Bridger Wilderness. Visibility impairment due to regional haze was calculated based on the IWAQM guidance. The maximum concentration of organic aerosol modeled at the wilderness boundary was reported as 0.067 $\mu g/m^3$, based on the ISCST3 model. Based on the WDEQ/AQD's continuing review of visibility data and the IMPROVE monitoring calculations, the maximum visibility impairment was calculated to be 0.18 deciviews. Based on the review, the proposed project will not significantly impact visibility in the Bridger Wilderness. The conclusion is made as the predicted deciview change is less than 0.5 deciviews.

6.7 Acid Deposition

A screening level assessment of acid deposition impact is typically performed using a technique presented by Fox (1983). This technique quantitatively estimates the change in pH on a sensitive water body (i.e., mountain lake) by incorporating predicted ambient

concentrations of SO_2 and NO_2. In addition, the conversion of predicted NO_2 concentrations from the SSAJV facility to applicable nitrate deposition values for use in the Fox technique was performed according to the procedures present on page 5-6 of the previously cited IWAQM document. Since the SO_2 emissions from the SSAJV facility will be minimal, evaluating impacts from resulting sulfate deposition is not necessary. The predicted NO_2 impacts from the SSAJV expansion at representative water bodies (Table 5-8) were analyzed. The PSD netting of NO_x was not taken into account for this analysis. NO_2 impacts were obtained by using the ISC model. The lakes were chosen for analysis as recommended by Ann Mebane of the US Forest Service in Pinedale.

The acid deposition results are presented in Table 6-7. The total potential loss of ANC, in μeq/L, by SSAJV expansion emissions was compared to the baseline for each lake. The resultant percent change was then compared to significance criteria such as 10 percent for waterbodies with baseline ANC's between 25-100 μeq/L or the even more stringent significance criterion of 1 percent which is the 10 percent criterion value divided by a safety factor of 10.

The change in pH from the nitrate deposited into the sensitive lakes was also estimated. These results are also presented in Table 6-7. The significance criterion for change in pH is typically 0.10 with some cited values up to 0.50.

Table 6-7: Summary of Maximum Acid Deposition Results

Name	Annual Modeled NO_x Impact ($\mu g/m^3$)	Lake Baseline ANC ($\mu eq/L$)	Δ ANC	Δ pH
Black Joe Lake	0.00118	46	0.655	0.0029
Deep Lake	0.00124	40	0.792	0.0035
Hobbs Lake	0.00086	57	0.386	0.0017
Ross Lake	0.00067	51	0.0336	0.0015
Saddlebag Lake	0.00138	28.4	1.242	0.0054
Klondike Lake	0.00076	20	0.971	0.0042
Upper Titcomb Lake	0.00082	34	0.616	0.0027

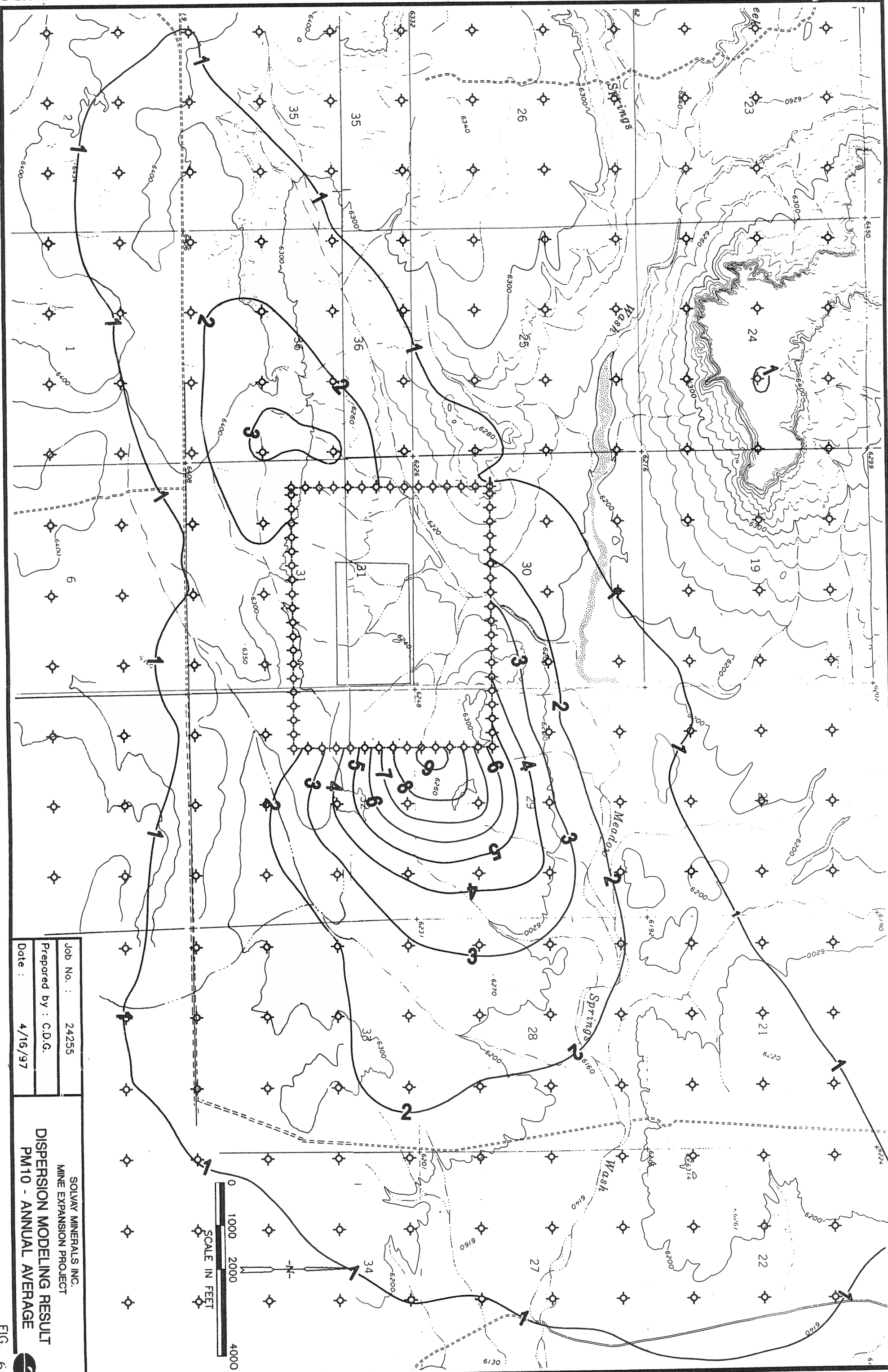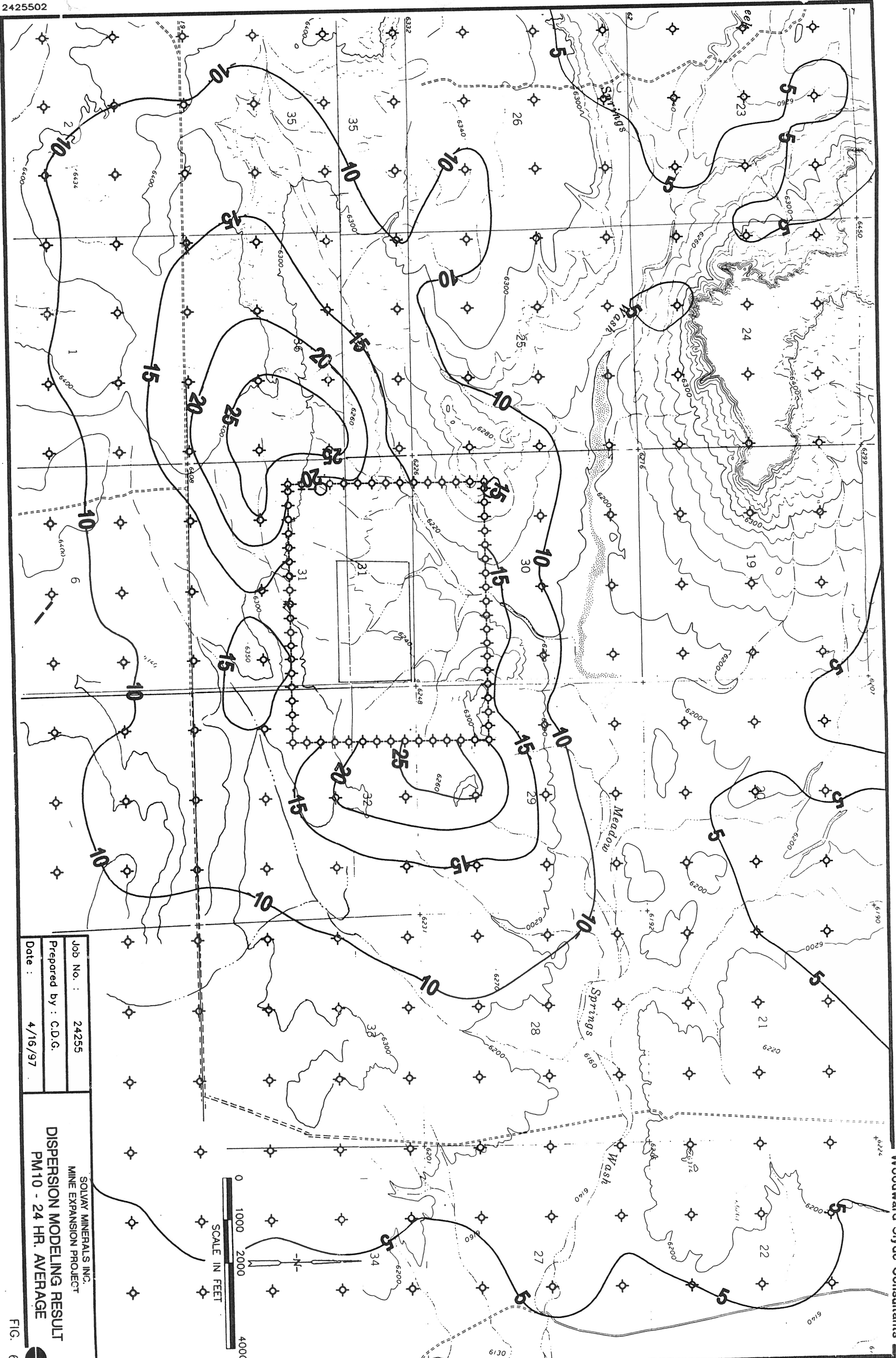NOTE: These results do not take into account the PSD netting of NO_x emissions.

SOLVAY MINERALS INC.
MINE EXPANSION PROJECT
DISPERSION MODELING RESULT
PM10 - ANNUAL AVERAGE

Job No. :	24255
Prepared by :	C.D.G.
Date :	4/16/97

FIG. 6-1

Woodward-Clyde Consultants

SCALE IN FEET
0   1000   2000   4000

-N-

DISPERSION MODELING RESULT
PM10 - 24 HR. AVERAGE

SOLVAY MINERALS INC.
MINE EXPANSION PROJECT

Job No. :	24255
Prepared by :	C.D.G.
Date :	4/16/97

SCALE IN FEET

0   1000   2000   4000

-N-

FIG. 6-2

2425502